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VOLUME 140 NO. 11 MARCH 18 1961 ONE SHILLING

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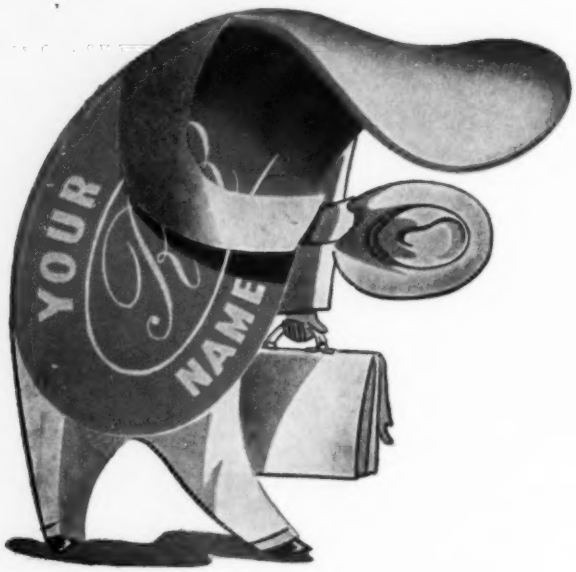

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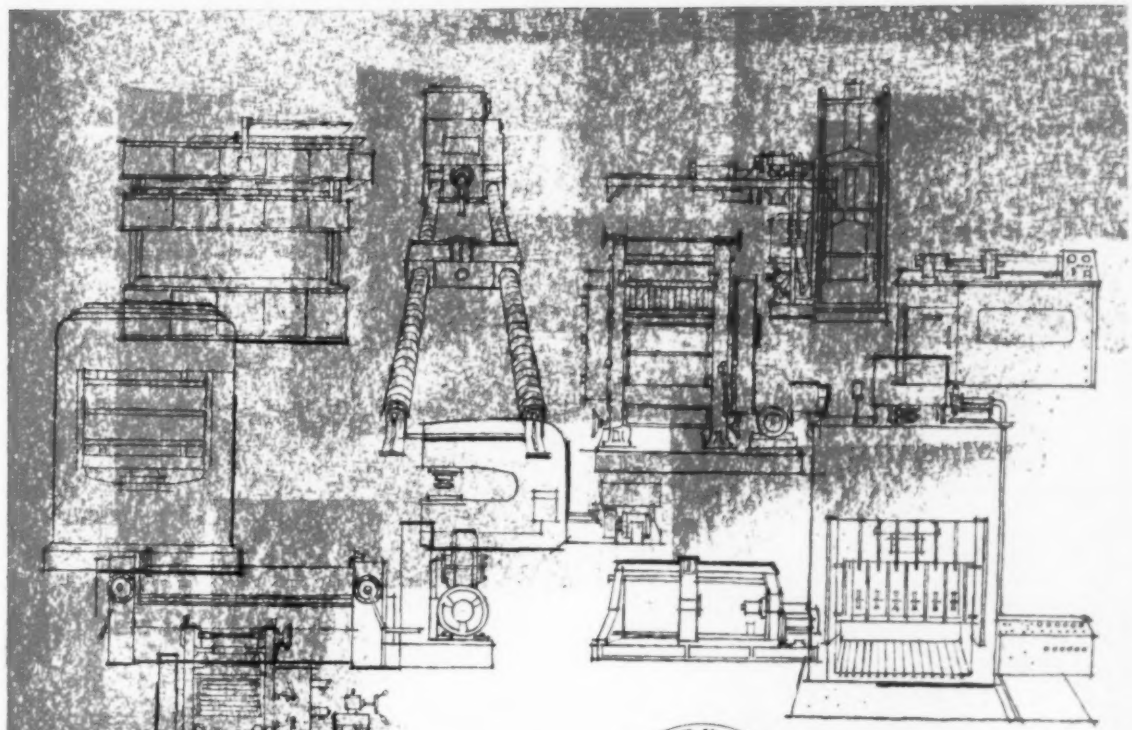

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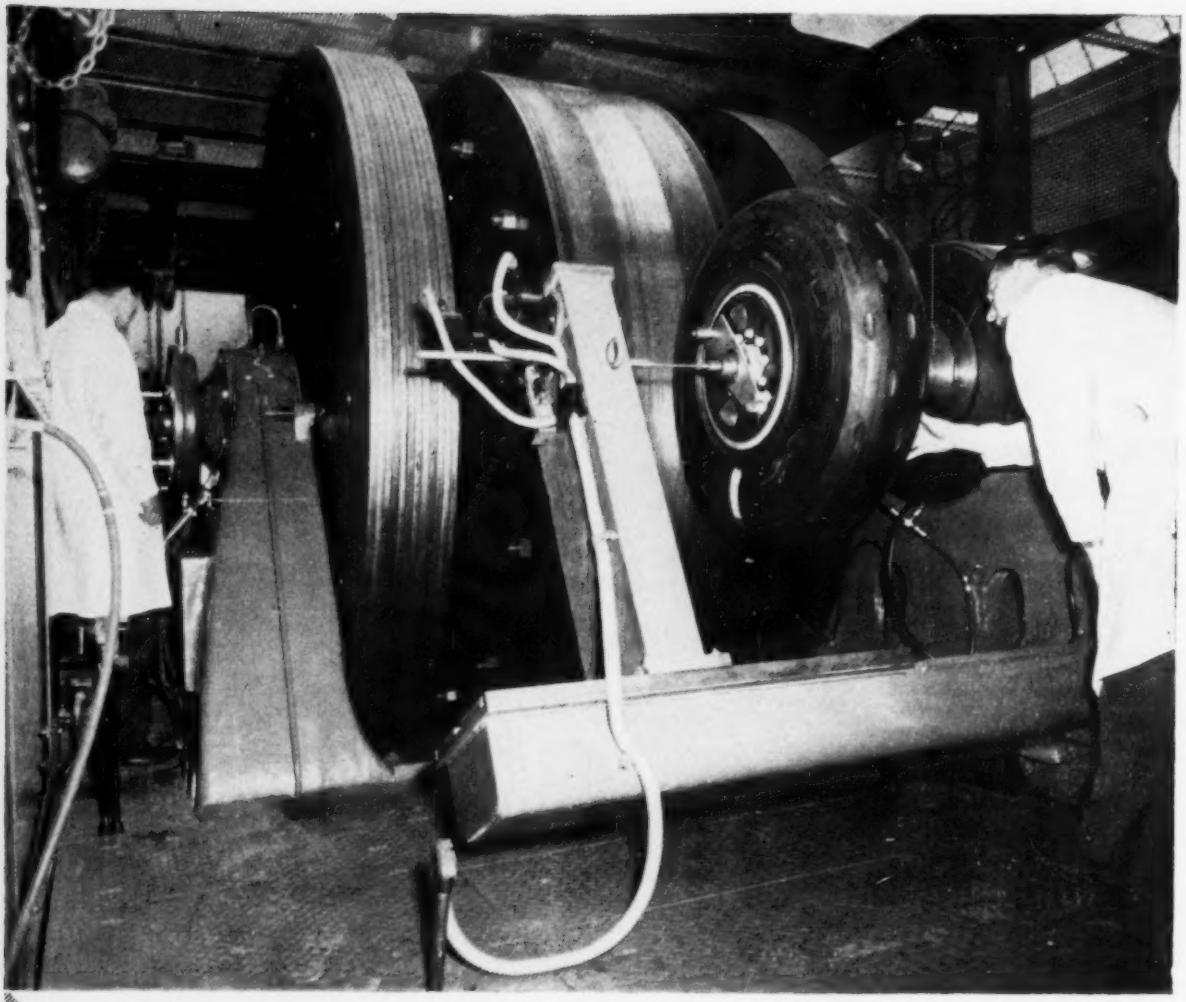

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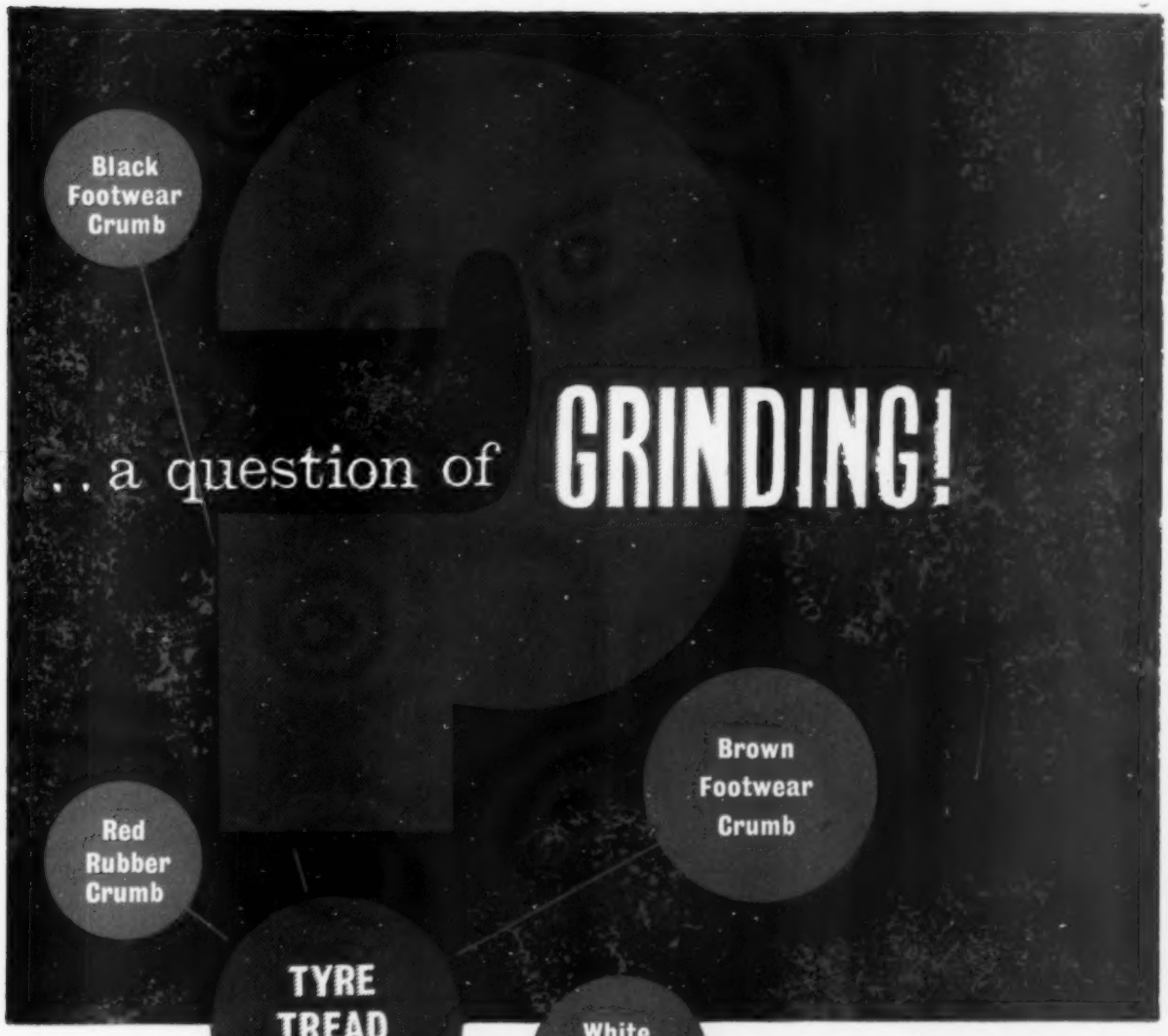

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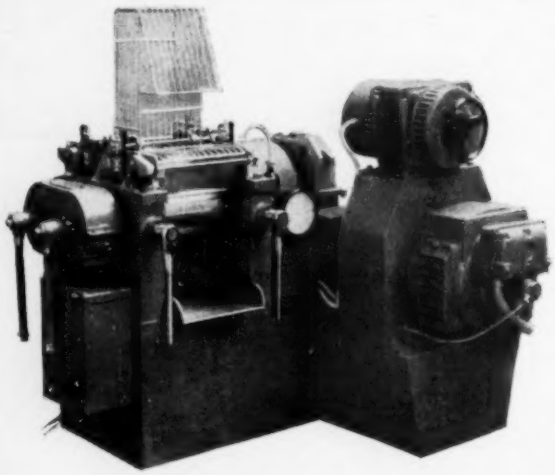

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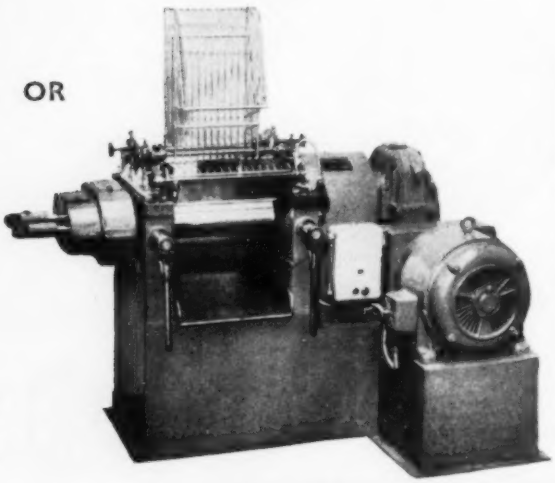

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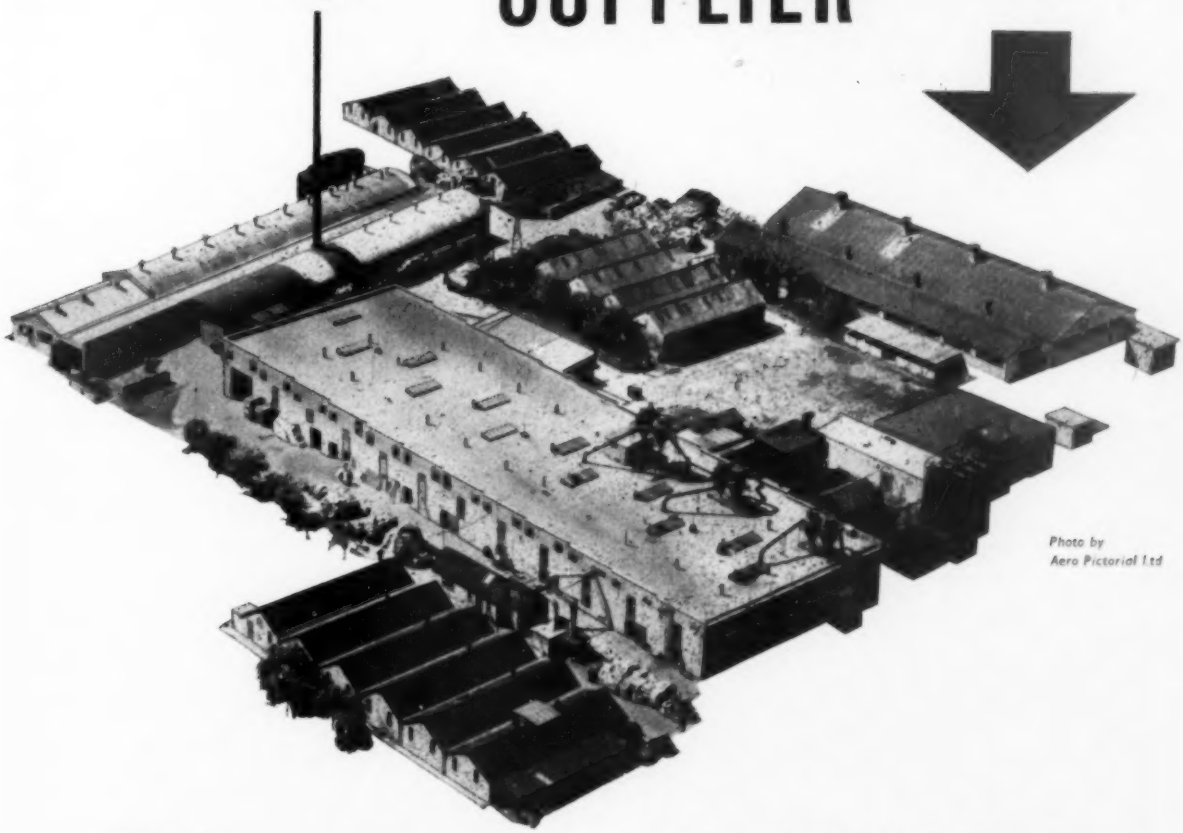

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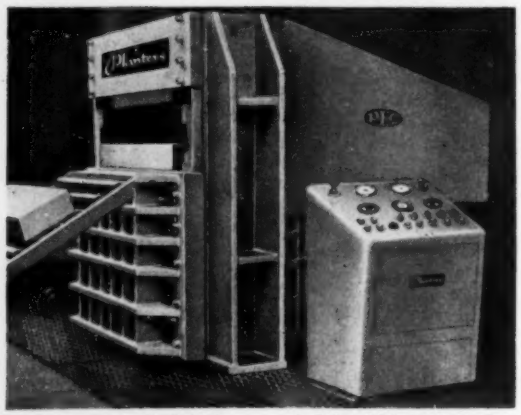

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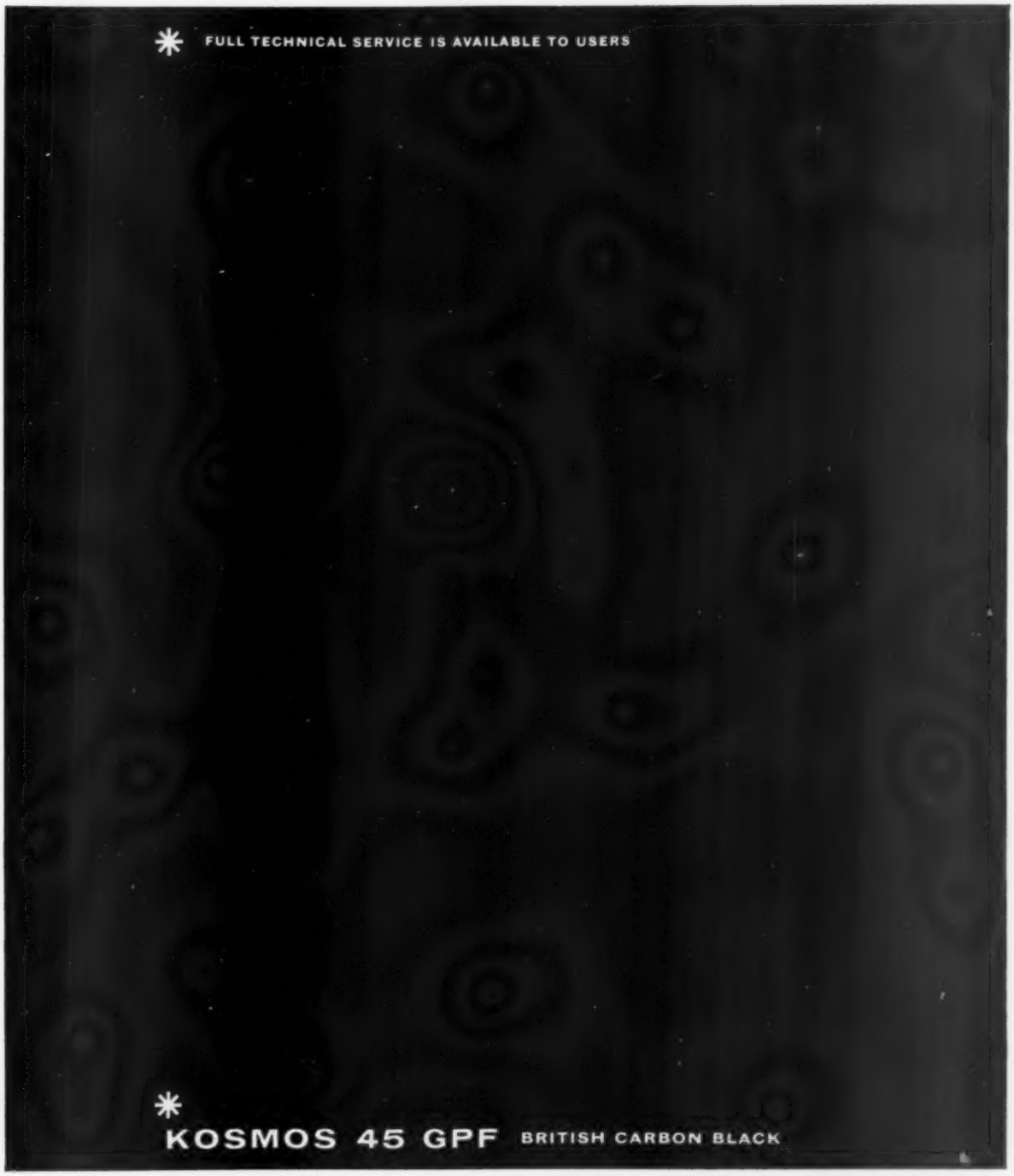

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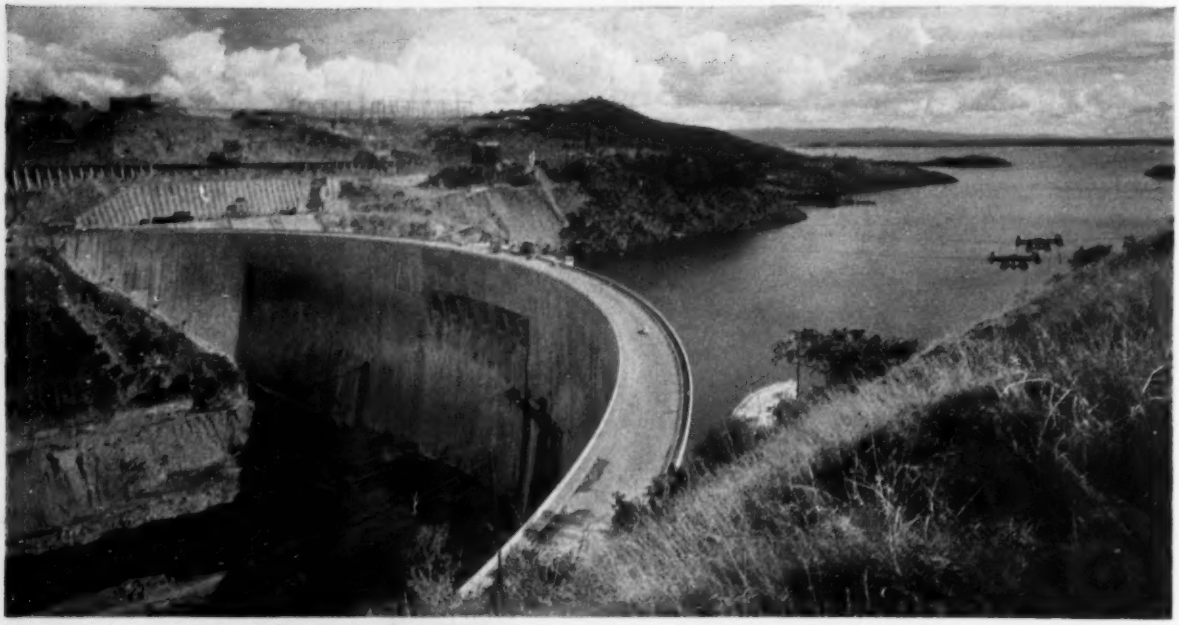

The Kariba Dam in Southern Rhodesia, which produces electricity from the waters of the Zambesi River. Blue 'Darvic' p.v.c. sheet was used to line part of the roof of the vast generator house, which is cut out from the rock of the gorge side. Civil Consulting Engineers: Gibb, Coyne, Sogei (Kariba) (Pvt.) Ltd.

The generator house at the Kariba Dam Power Station. The striking, deep blue lining of the roof that forms a contrast to the curved false ceiling is made from 'Darvic' p.v.c. sheet. This lining has the practical function of draining away highly alkaline water which continually drips from the concrete roof lining above.

A close-up view of the 'Darvic' sheet used at Kariba. Each sheet is 5 ft. 6 in. x 3 ft. 6 in. and only $\frac{1}{8}$ inch thick. For added strength the sheets are corrugated at regular intervals and right-angle strips of 'Darvic' are cemented to the underside. They are screwed to extruded p.v.c. sections slung from metal stringers grouted into the roof. The edges are held firmly to the supporting strips by a rigid p.v.c. 'snap-on' section. The sheeting was specially corrugated by Rediweld Limited, 17/27 Kelvin Way, Crawley, Sussex.

'Darvic' beats corrosion at Kariba

Many problems confronted the builders of the newly opened Kariba Dam. One of them was caused by water dripping slowly from the concrete lined roof of the vast hall which has been hewn out of solid rock to house the turbines and generators. The problem was made worse by the high alkali content of the water. Most of this alkaline water was channelled away by a concrete and plaster false ceiling painted on the top with bituminous paint. But the architects wanted a different, deeper-coloured material to line the roof where there was no false ceiling. For this job they chose 'Darvic' p.v.c. sheet. Apart from its striking appearance 'Darvic' suggested itself for this job by its resistance to chemical corrosion. 'Darvic' also offered the architects a lightweight sheet which was none the less rigid and dimensionally stable, and which could be corrugated or shaped as required. 1,250 sheets of 'Darvic' were used and the whole installation was planned and carried out under the guidance of the I.C.I. Technical Service and Development Department.

The success of this use of 'Darvic' at Kariba is demonstrated by these photographs, and by the fact that, although the bituminous paint on the false ceiling has been attacked by the alkaline water and has had to be replaced, the 'Darvic' is still in perfect condition.

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RUBBER and PLASTICS WEEKLY

Formerly 'Rubber Journal and International Plastics'

Volume 140 *IN ITS 77th YEAR* **No. 11**

March 18 1961

Editorial

NOTES OF THE WEEK 411

Articles and News

NEWS BRIEFS 412
POLYPROPYLENE EXPANSION 413
THERMOPLASTICS AT INTERPLAS 414
DEVELOPMENT OF EPOXY RESINS 416
THOMAS MARTIN 419
RUBBER RECLAIMING PROCESSES 420
AMERICAN LETTER 423
ENGINEERING ASPECTS OF ACETAL RESIN 426
ACTIVE YEAR FOR THE BPF 428

Features

VIEWS AND REVIEWS 430
MEN AND MATTERS 433
THE LEGAL ANGLE 435
RUBBER STATISTICS 436
PLANTATION COMMENTARY 436
RUBBER AND PLASTICS STOCK MARKET 437
RUBBER MARKETS 439
INDUSTRY INTELLIGENCE 441

Classified Advertisements . . . 443 Advertisers Index . . . 446

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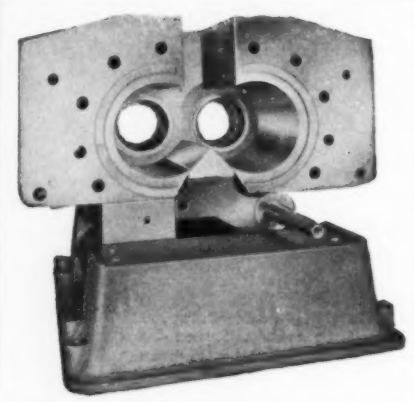
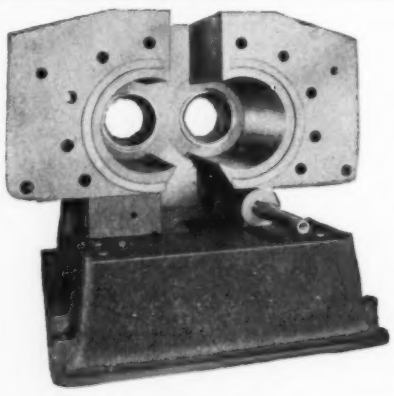
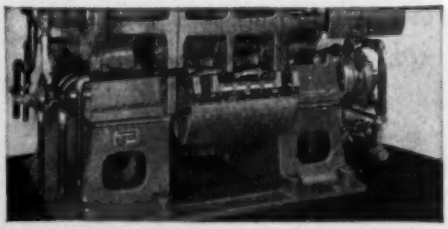


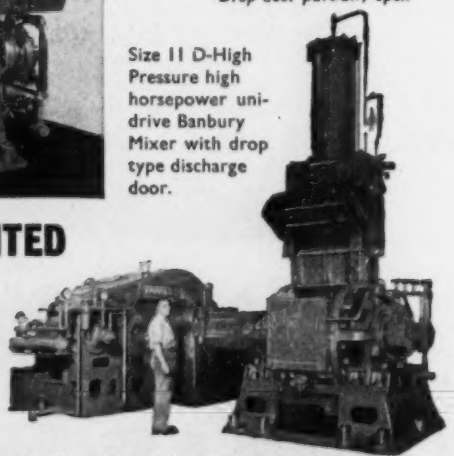
Chamber of Banbury with drop door in closed position



Drop door partially open



Angular view of drop door in open position



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NOTES of the WEEK

A Remarkable Year

THE annual general meeting of the British Plastics Federation, held on Wednesday (March 15), brought into sharp focus the fact that 1960 was a remarkable year in its development. A major achievement was the bringing of the long negotiations over research to a successful conclusion with the formation of the Rubber and Plastics Research Association. It is well to remember, however, that although adequate support was obtained, the new association had a founder membership of only 70 companies in the plastics group, which is only about 24% of the total membership of the Federation. The change in the Federation's membership figure itself — an increase of only 3% — does not seem to reflect the amount and quality of work that has been done.

Apart from the new research association, and other home activities, the Federation played the leading part in the talks which were held recently with representatives of the plastics industries in other EFTA countries. The objectives of these talks may be a matter of long-term policy, but as C. H. Glassey, the retiring president, said at the meeting: '. . . agreement by the EFTA countries on procedure is a matter of urgency if the respective governments are to be promptly and regularly briefed on the views of the plastics industry during the period of negotiations ahead, which may be both detailed and prolonged'.

This is a good example of the sort of work that a trade association, and only a trade association, can do for its industry. Firms both inside and outside the Federation stand to benefit. This would seem, therefore, an appropriate time for the Federation to try and attract new members. The new booklet 'The Aims and Objects of the Federation', which is to be published shortly, should be useful in this connexion. Certainly, if it reflects last year's achievements, it should stimulate those outside the Federation to consider applying for membership.

Transmitting the Results

MR GLASSEY pointed out at the Federation's annual meeting that the plastics industry must equip itself, both on the engineering side and on the technique of application, if it is to take full advantage of the opportunities in structural plastics. The point was probably levelled at static structures, but it applies equally well to plastics used in vehicles. An interesting approach to the car engineer was made last week in a seminar organized by Du Pont (UK), and it could be studied with profit by plastics firms preparing to enter the building industry. In another few years engineers may be turning to plastics firms and asking them to solve particular problems. At the moment the tendency is the other way about; the plastics firm must transmit the results of its research and development to the engineer. This seminar, which dealt with plastics — acrylics, acetals, nylon and polycarbonates — as engineering materials, was certainly a good means of transmission.

Bridging the Gap

THE star of the Du Pont seminar was undoubtedly acetal resin, the price of which was recently brought down to equal that of light metals, such as zinc die/casting alloy on a price/volume basis (*RPW*, February 25, 284). The strength of this resin at temperatures up to 250°F. opens up a field of applications which, up till now, has been catered for exclusively by metals — applications such as carburettor components, fuel pump parts and instrument housings. The resin was introduced in USA only a year ago, but already there are over 500 applications, 80% of these being in the 'metal field'. (The only plastics with which acetals are likely to compete are nylon and polycarbonates.) In the UK 200 applications are being developed and the recent price cut should see a rapid increase on this figure. It is likely that the price will fall even further as the usage increases, and in about a year's time we may see it level off at 4s. a lb. or even less. (The current price is 5s. 2d. a lb., which compares with about 7s. 6d. a lb. for nylon and about 9s. a lb. for polycarbonates.) As well as Du Pont, American Celanese is said to have started production of an acetal copolymer at its Clarkwood, Texas, plant, and European production of the polymer must be under serious consideration.

It is not going too far to say that acetal resin represents a new concept in plastics, a move towards bridging the gap between plastics and metals. In the search for materials with a better balance of properties, the metallurgist and the plastics technologist start from roughly opposite positions. The properties frequently aimed at by the metallurgist are lightness and corrosion resistance. Starting with these properties, the polymer chemist has tried to add to them some of the natural advantages of metals. Acetal resin, rigid without being brittle and with high dimensional stability — and keeping these properties over a range of temperatures and humidities — if it does not bridge the gap between metals and plastics, at least throws a very strong rope across.

NEWS *Briefs*

WINDSOR AND I.C.I. LEIPZIG ORDERS—POLYMER DIENE PLANT?—MARLEY DOWN UNDER—PIRELLI LOAN—YUGOSLAV QUOTAS—LINEAR PE MARKET

●**Holland** — Two Dutch shipyards — Verschure and Co.'s Scheepswerf en Machinefabriek NV, of Amsterdam, and Scheepswerf Westhaven, of Zaandam — have established Verschure-Westhaven Polyboat NV with the object of building polyester motor yachts.

●**Ceylon** — Ceylon will buy 40,000 tons of petroleum products a year from the Soviet Union over the next two years, it has been officially stated in Colombo. The Ceylon Government has already decided to set up a State Oil Corporation which will handle oil imports from Russia. In addition to the oil, Ceylon will also purchase machinery and equipment from Russia, which has in turn agreed to step up imports from Ceylon, including rubber.

●**Italy** — A total of 500 tons of natural No. 2 RSS rubber in bales from the Government stockpile, is to be sold by public tender.

●**Canada** — Shell of Canada has been informed by the Alberta Oil and Gas Conservation Board that it will approve the company's plan for a multi-million-dollar gas processing sulphur recovery plant in the Waterton-Pincher Creek area of south-western Alberta. Construction is expected to be completed by the end of this year, and it is estimated that the process will cost $20m.

●**United States** — Dr R. E. Huise, general manager of US Industrial Chemicals Co., has commented on recent remarks about over-capacity in the linear polythene field, in view of the fact that his company is to build a 60m. lb. linear polythene plant at Houston, Texas. 'We believe that over-capacity is a short term problem', he said. 'Every market projection we have made indicates that this versatile plastic will be in short supply by early 1963'.

●**New Zealand** — Marley Tile Co. Ltd., which operates a factory in Auckland, is considering the broadening of its range of products manufactured there. J. A. Aisher, the company's financial director, stated when he visited New Zealand recently that the next logical step would be the production of roofing tiles. He felt that another factory might have to be built to cope with increasing demand.

●**East Germany** — Imperial Chemical Industries' dyestuffs division has signed a £150,000 contract at the Leipzig Spring Fair with the East German State Trading Organization, Dia Chemie. The contract includes rubber chemicals. Among other deals concluded was a £50,000 contract gained by R. H. Windsor for injection moulding machines for the Zeiss at works at Jena.

●**Canada** — Polymer Corp. is to build a plant at Sarnia 'to produce a new synthetic rubber useful in heavy duty truck tyres', Defence Production Minister Raymond O'Hurley announced in the Canadian House of Commons. He said it was hoped to bring the plant, costing $10m., into production by the end of 1962. No further information is available from Polymer, but it seems likely that the 'new synthetic' is polybutadiene.

●**India** — A West German, a Dutch and a Swiss company are to assist the Century Rayon Company of Bombay, in the erection and equipping of a factory to produce rayon cord for tyres. The German company is Vereinigte Glanzstoff-Fabriken AG, which will co-operate with AKU of Arnhem, and A. Manurer SA of Berne, in assisting the Indian company. The plant, to be built in Kalyan, near Bombay, is scheduled to start production towards the end of next year.

●**Switzerland** — A group of banks headed by the Swiss Bank Corp. has announced that it will offer for public subscription a loan of 20m. Swiss francs on behalf of Société Internationale Pirelli SA of Basle. The proceeds of the loan are to be used for an expansion of the activities of Pirelli's British subsidiaries in the tyre and cable sector, and also for the development of subsidiaries set up in Canada and South America.

●**Yugoslavia** — Among the goods which may be imported freely into Yugoslavia under new quota lists are natural, synthetic and regenerated rubber and revertex and latex. The list of goods for which import quotas have been set includes rubber tyres and inner tubes.

●**United States** — The United States Rubber Co. has announced price increases of 5% for first line passenger tyres and 2½% for highway type truck tyres, effective from April 1.

'That's an excellent question, sir, and I'm going to give it the respect it deserves by not attempting a quick superficial answer here. Instead, I'd like to refer you all to my recently published book on the subject which tells the whole fascinating story in straightforward, simple terms, copiously illustrated — five hundred action packed pages . . .' — 528

Polypropylene Expansion

I.C.I. TO RAISE CAPACITY TO 22,000 TONS

IMPERIAL Chemical Industries Ltd. is to double the capacity for polypropylene at its Wilton complex. This is the latest of a series of expansion announcements from the company, which include setting up a £100m. complex within the Common Market, and raising the pvc capacity at Hillhouse.

Part of I.C.I.'s polypropylene plant at Wilton — the stock tank area

New extensions are to be built which will increase the output of polypropylene from 11,000 to 22,000 tons.

The decision to expand comes only four months after the opening of the plant, and still further extensions are contemplated. At the time of the opening E. G. Williams, joint managing director, said: '. . . we are sufficiently confident of the product's future to be already making plans for rapidly doubling the capacity and later trebling or even quadrupling it'.

Constructors John Brown Ltd., who built the original plant, have been given the contract for the new extensions. The original plant was completed in record time — the work began in May 1959 and was finished by September 1960.

Applications

The largest single outlet for polypropylene is in the injection moulding field for applications where the high rigidity, high softening point and low density of the new plastic are of particular value. These include automobile parts, luggage accessories, television sets and components of washing machines, spin driers, refrigerators, and medical and surgical equipment.

Considerable interest is also being shown in polypropylene for sheet manufacture, which provides opportunities for the fabrication of many types of large containers such as water cisterns.

Polypropylene film and fibre are being actively developed by I.C.I. and these applications are expected to absorb a considerable tonnage of material. (I.C.I. holds the licence from Montecatini for the exclusive UK production of polypropylene yarn and fibre.)

At the moment I.C.I. is the only bulk manufacturer of polypropylene in the UK. Shell's Carrington polyolefin plant, due to come on stream at the end of this year, will produce 15,000 tons of polypropylene interchangeably with 15,000 tons of low-density polythene.

The present price of polypropylene is about 3s. a lb., which compares with about 2s. 6d. a lb. for high-density polythene and 1s. 10d. a lb. for low-density polythene.

Ralph W. Stewart

The liquidator for Ralph W. Stewart and Co. Ltd., the Fife rubber firm, has announced that the only asset remaining to be disposed of is the ground and property at Elgin Works, Dunfermline, comprising factory, warehouse and garage space totalling 80,000 sq. ft.

Although several enquiries have been received for major sections of the works, the liquidator reports that only minor sales have been made.

Standards Engineers' Conference

The seventh annual conference of engineers and others concerned with the application of standards, will be held this year on May 9 and 10, and will be opened by the Rt. Hon. Viscount Hailsham, Lord President of the Council and Minister for Science.

Preparing for Structural Plastics

C. H. Glassey, retiring president, addressing the British Plastics Federation's annual general meeting in London on Wednesday (March 15) said that it became increasingly obvious that the industry had to equip itself both on the engineering side and on the technique of application if it was to take full advantage of the opportunities presenting themselves in the relatively new field of structural plastics.

EFTA Talks

'One has only to study current literature in this connexion to appreciate that these outstanding opportunities are not being lost sight of by the industry's research and development personnel,' he said.

Mr Glassey also referred to the vital importance of the part which the Federation was playing in talks with the representatives of the plastics industries in the EFTA countries.

'Although the objectives may appear as a long-term policy', he stated, 'agreement by the EFTA countries on procedure is a matter of urgency if the respective governments are to be promptly and regularly briefed on the views of the plastics industry during the period of negotiations ahead, which may be both detailed and prolonged'.

Active Year for the BPF: page 428.

PVC for Canberra

Through its agents in Belfast — James P. Corry and Co. Ltd. — Phoenix Rubber Co. Ltd. has supplied and fitted pvc sheeting for the floors of three of the bars in the 45,000-ton *Canberra*, which makes its maiden voyage to Australia on June 2. This is believed to be the first time that electrically-welded pvc has been used for flooring in an ocean-going liner.

Surface Active Agents

A range of ethylene oxide derivatives of lanolin alcohols is being marketed by Croda Ltd., Cowick Hall, Snaith, Goole, Yorkshire.

These surface active agents were offered under the name of Etolan, but owing to an infringement of trade mark, this name has been withdrawn and the name Polychol substituted.

Thermoplastics at Interplas

THEME OF INTERNATIONAL CONVENTION

HELD in conjunction with Interplas 61, the sixth International Plastics Exhibition at Olympia, London (June 21-July 1), the International Plastics Convention will survey current technical and commercial progress in thermoplastics — the fastest-growing section of the plastics industry. In three of the sessions international authorities will review advances in polymers and market prospects for polyolefins, vinyls and styrene polymers. A fourth session will be given to advances in the processing of thermoplastics.

Polyolefins will be dealt with on June 26 by H. C. Raine, research director of the plastics division of Imperial Chemical Industries Ltd. He will give a review of technical developments, and W. A. Woodcock, vice-president, Union Carbide International Co., is to survey end-use trends and details of output throughout the world. Dr Gerd H. Bausback of Farbwerke Hoechst, Germany, will speak on the commercial trends of polyolefins in Europe, concentrating on high density polymers and polypropylene.

In the session on vinyls (June 27) technical developments will be dealt with by Dr J. J. P. Staudinger, technical director, Distillers Plastics Group, and another speaker will deal with commercial aspects. On the same day, material developments of styrenes will be covered by Gordon Thayer, and Freeman R. Lehman, of Dow Chemical Co., and the commercial aspects by V. Norman Luke, commercial manager, Shell Chemical's plastics and rubbers division.

Processing thermoplastics (June 28) will be covered in four papers: single screw injection moulding by Dr A. Kleine-Albers, technical head of Ankerwerk Gebr. Goller, Germany; bottle blowing techniques by J. F. E. Adams of the Metal Box Co.; extrusion equipment by Dr Gerhard Schenkel, chief of development at Paul Troester, Germany; and film manufacturing techniques by David Grant, technical director of Bone Brothers.

Over 350 firms from 13 countries have so far arranged to display their products at Interplas 61. Countries to be represented include Austria, Belgium, Canada, Denmark, Finland, France, Germany, Holland, Italy, Sweden, Switzerland, the UK and the USA.

The exhibition will cover an area of 360,000 sq. ft.

Extruder in Spain

Fawcett Preston, a company in the Metal Industries group, is to supply a Davis-Standard 6in. British thermatic extruder for cable covering to Pirelli's associated company in Spain.

Powered by a 200hp drive, the machine is capable of covering cable up to 5½in. diameter with a plastic protective sheathing.

Sports Exports

Dunlop Sports Co. exported sports equipment in 1960 valued at just over £1¼m., a quarter of the UK total exports of sporting goods.

Of the total output of golf balls, some 55% went abroad; tennis balls, 65% and table tennis bats and balls, 70%.

VINYL/COTTON FABRIC

Storeys of Lancaster is now producing an expanded vinyl backed with knitted fabric which is said to be 'a truly supple material resembling soft leather'. The firm calls it Neolan 350 and claims to be the first UK manufacturer of this product, which has been produced by a new process designed to give properties of extensibility and recovery.

Similar types of material — 75% cast vinyl and 25% knitted cotton — were introduced into the UK early last year from Germany and USA (*RPW*, Nov. 12, 814). It has been used in the manufacture of jackets and handbags.

Storeys is producing three colours at the moment — parchment, black and white — with others to come. It is initially available on allocation only until full production is achieved.

Other firms thought to be interested in producing a similar material include Commercial Plastics Ltd. and Rubber Improvement Ltd.

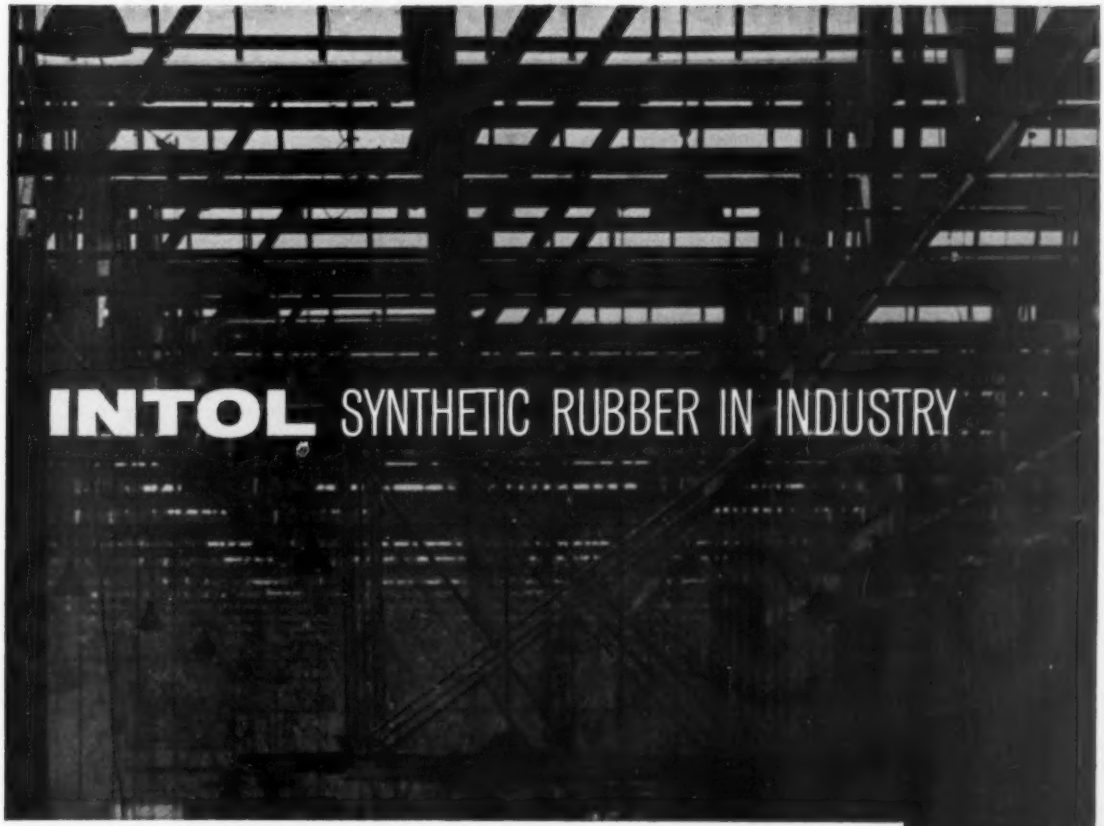
£2m. Plant Built in a Year

AT Aintree, Liverpool, building work on a £2m. cellulosic packaging film factory is nearing completion in under 12 months. The plant, consisting of eight new buildings, is for British Enka Ltd. in the grounds of their existing factory. It will manufacture viscose-based transparent wrapping films.

Rapid construction was essential so that production could start as early as possible. Only six weeks after the main contractors, Cubitts Ltd., decided to use a scheme of precast concrete portal frames as the skeleton for the giant casting hall, the first section went into position on the site.

Three of the eight new buildings are joined to the company's existing factory. The main building is the giant casting hall where the matured viscose is extruded in a continuous sheet throught a very fine slit in a pouring hopper, and passes over and under a series of rollers through casting tanks where it is washed, bleached, softened and dried. The cellulosic film is then wound into rolls up to five miles in length.

The depositor technique is one of the most modern methods of production in glass-fibre fabrication. At Osma Plastics Ltd. a Criss Depositor using Turner's Duraglas chrome complex rove (ECR 114) is operated to lay up glass reinforced plastic fascia panels for AEC Routemaster buses



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Development of Epoxy Resins

CONSUMPTION INCREASING BY 10-15% A YEAR

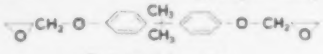
By R. F. WEBB, BSc, PhD, Director of Research, Ciba (ARL) Ltd.

IN the last 15 years or so there has been a great increase in research on plastic materials and a large number of new products have been brought forward, the most spectacular of which have been the newer types of thermoplastics, the polyolefines. However, thermosetting materials have also been intensively investigated and the most versatile of these, the epoxy resins, are now beginning to be big business. The first epoxy resins were based upon the condensation of epichlorohydrin with a dihydric phenol, bisphenol A, and these still form the basis of the majority of commercial products, but other epoxy-containing materials are now appearing on the market which will further add to the uses of epoxies in industry.

The first epoxy resins were developed independently by Castan in Switzerland and Greenlee in the US about 1938, and the commercial availability of epichlorohydrin which is an intermediate in the production of synthetic glycerol from propylene and a recognition of their diverse uses, led to the rapid commercial exploitation of these resins after the war. Since 1954 their use has been increasing by 10-15% a year.

Chemistry

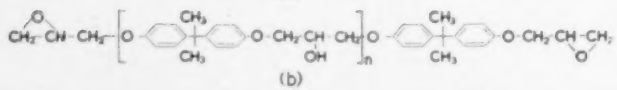
The most widely used epoxy resins are based upon the alkali-catalyzed condensation of epichlorohydrin with bisphenol A which is a condensation product of phenol and acetone. Use of an excess of epichlorohydrin gives a liquid resin which is mainly as in Fig. 1 (a), whereas at lower epi/bisphenol ratios a range of solid products Fig. 1 (b) are formed, the highest molecular weight of which are used in paint manufacture.



η-80-200 poises

(a)

Fig. 1



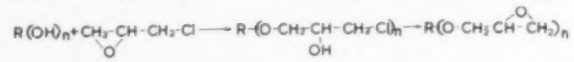
(b)

The resins are therefore glycidyl ethers of bisphenols.

Many other phenols have been employed for the production of this type of epoxy resin including resorcinol, hydroquinone, phenol-formaldehyde condensation products or novolaks and resorcinol novolaks.

Certain special resins useful for the production of materials with high thermal stability have been produced from polyfunctional phenols such as 1,1,2,2 - tetra(4 - hydroxyphenyl) ethane (from phenol and glyoxal).

Glycols and polyols such as butandiol, glycerol, ethylene glycol and polyalkylene glycols can be converted into their glycidyl ethers by reaction with epichlorohydrin and a Lewis acid, *e.g.* stannic chloride followed by ring closure of the chlorohydrin to produce the epoxide (Fig. 2).

Fig. 2 

The lower polyols and polyethylene glycol give water soluble epoxy compounds some of which find use as anticrease agents for cellulosic textiles, cross linking of the textile fibres occurring by reaction of the bis-epoxides with the cellulose hydroxyl groups catalyzed by fluoroborates — a reaction similar to that just mentioned for the formation of the epoxy resins from the glycols.

Epichlorohydrin reacts readily with amines to form glycidyl derivatives. Reaction with aniline, for example, gives a resin containing two epoxy groups and a diaminodiphenylmethane one with four epoxy groups (Fig. 3).

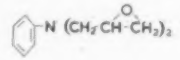
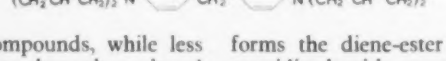


Fig. 3



The epoxy compounds, while less stable to storage than those based upon phenols (since the tertiary amine groups catalyze polymerization of the resins), can find outlets for the production of adhesives and laminating resins and as modifiers of the viscosity of the phenol-based types (reactive diluents).

The glycidyl products derived from low molecular weight polyamines are useful reagents for treatment of paper to improve wet strength but find little application in casting resins or general surface coating since they are difficult to store and give products with poor properties such as high water absorption.

Within the last three to four years considerable interest has been displayed in a class of epoxy-containing resins not based upon epichlorohydrin but which employs the oxidation of polyolefines with peracetic and/or other peracids.

One class of epoxy resin formed in this way utilizes the Diels-Alder reaction between conjugated dienes (*e.g.* butadiene) and a dienophile to produce substituted cyclohexanes which are then linked to form di or tri cyclo olefines which with peracetic acid give di or tri epoxides represented schematically in Fig. 4.

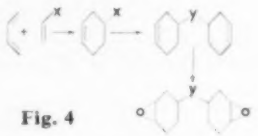


Fig. 4

Reaction of butadiene with crotonaldehyde to give the tetrahydrobenzaldehyde followed by Tischenko reaction with aluminium isopropoxide forms the diene-ester which can be epoxidized with peracetic acid to a colourless resin of low viscosity which cures with anhydrides to products with high heat distortion points (Fig. 5).

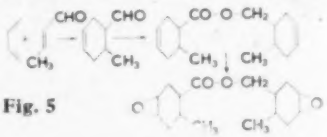
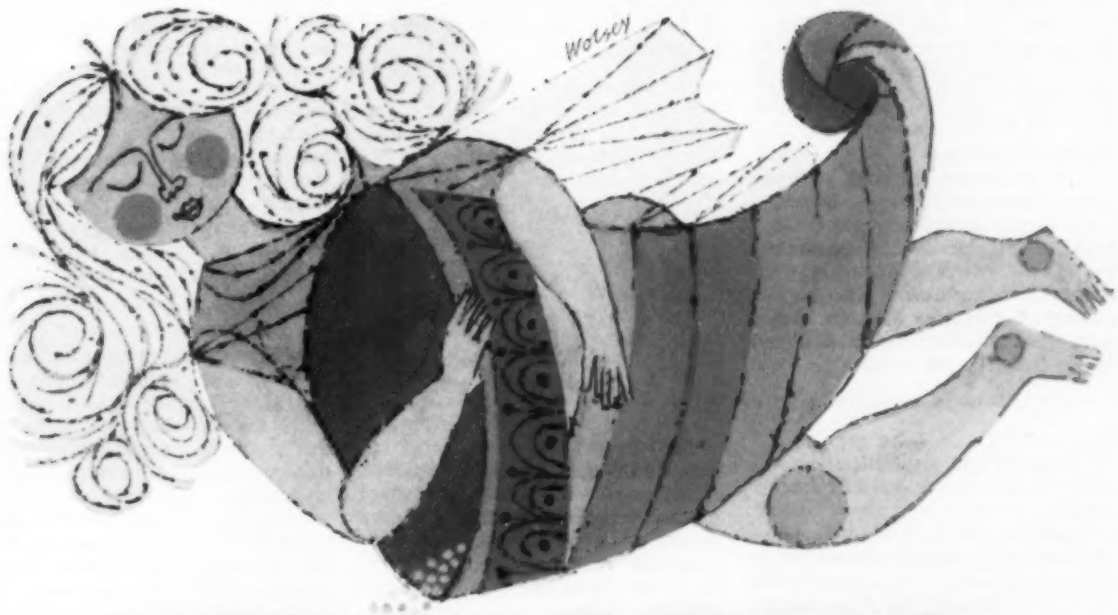


Fig. 5

Other recently developed resins include epoxidized soya-bean oil and other natural fatty oils used mainly as plasticizers and light stabilizers for chlorinated polymers such as pvc where the epoxy groups neutralize the hydrogen chloride liberated by the action of ultra-violet radiation. Yet another class recently developed are



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epoxidized butadiene polymers where the pendant 1, 2, and back bone 1, 4 olefinic centres are partially epoxidized. These are of particular interest since they may also be cross linked by copolymerization with styrene or by free-radical sources in addition to the usual curing agents employed for the epoxy groups.

Curing of Epoxies

Like monoepoxides such as ethylene oxide or propylene oxide, epoxy resins can be catalytically polymerized by alkoxides, Lewis acids or tertiary bases, the mechanism being, for example, with a tertiary base the formation of a betaine structure which then promotes attack by the hydroxyl ion formed (Fig. 6).

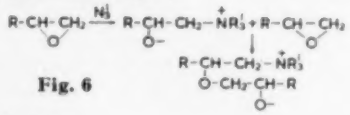

Fig. 6

Analysis

The epoxy content of most resins can readily be determined by reaction with strong acids and estimation of the acid uptake — HCl in acetone or pyridine and HBr in acetic acid being the usual reagents employed.

Cross-Linking

Amines are frequently used as curing agents for epoxy resins other than those formed by epoxidation of olefines and here each epoxy group is theoretically equivalent to one active hydrogen.

The reaction can be represented as shown in Fig. 7 using aniline as an example.

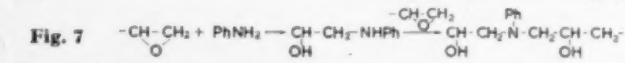

Fig. 7

The tertiary amine centre can then catalyze cross linkage formation as for catalytic polymerization and the hydroxyl groups formed may also react to form cross-linking ether bridges. In general, however, polyfunctional amines such as triethylene tetramine or diaminodiphenyl methane are employed to give the cross-linking necessary for a thermosetting resin.

Aliphatic amines are usually reactive enough to set up an exothermic reaction in the curing mass which speeds up the cure, aromatic amines are often hot cured and all amine cured systems benefit by a subsequent post cure of the reacted materials. A wide variety of amine curing agents are employed in epoxy resin technology, each having its own specific uses.

Anhydrides are another class of curing agents employed with all types of epoxy resins. The reaction can be represented as an esterification reaction shown in Fig. 8 (a) but in general less than one mole of anhyride is employed per epoxy group and a competing reaction shown in Fig. 8 (b) is that of etherification induced by the acid catalyst.

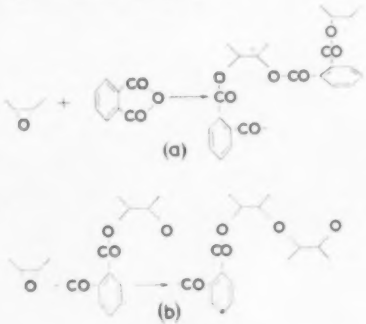

Fig. 8

The proportions of anhydride to resin must therefore be determined experimentally to give the amount of hardener required for the optimum properties since both unreacted anhydride or unreacted resin affect the properties of the cured resin disadvantageously.

Among the anhydrides employed are phthalic anhydride, hexa and tetra hydrophthalic anhydrides and other Diels-Alder products formed from maleic anhydride and conjugated dienes such as methyl cyclopentadiene (liquid anhydride) and hexa chlorocyclopentadiene which gives a hardener producing flame retardant and heat stable cured products. Particularly highly cross linked cured resins can be obtained by using pyromellitic dianhydride as a curing agent, and the choice of each hardener to be employed depends upon the physical and chemical properties required in the cured product.

In general, highly cross linked structures and, in particular, cyclo olefinic epoxides, give high heat distortion temperatures, good chemical resistance, hardness and electrical properties (*i.e.* are good insulators) but tensile and impact strengths decrease.

An interesting new series of curing agents have recently been developed which are cyclic anhydrides of boric acid and which provide low temperature curing of all types of epoxy resins. These function in the same manner as the organic acid anhydrides.

Additives

Accelerators

Although a variety of curing agents can be used, it is often necessary to accelerate the cure cycle to obtain for example a greater turn-round of moulds and hence a series of accelerators have been produced. Typical is the use of tertiary bases to accelerate anhydride cure.

Diluents

The conventional epoxy resins are often too viscous at low temperatures for easy working and diluents may be used which include non-reactive solvent types and those which themselves contain epoxy groups and are termed reactive diluents. In general, diluents lower the heat distortion point.

Modifiers

Epoxy resins can be used in conjunction with phenolic resins, urea and melamine resins and polyester resins and co-cured with these and this is especially useful in the production of cheap surface-coating materials.

Other resins may also be upgraded by admixture with epoxy resins, which may be used for example to impart rigidity or improved mechanical properties to other resins such as silicones, fluorocarbons or polyvinyl carbazoles.

Plasticizers

Many conventional plasticizers are incompatible with epoxy resins (tricresyl phosphate, dioctyl phthalate) and flexibility is obtained by using an epoxy containing flexibilizer such as epoxidized soya bean oil or flexible curing agents.

Three classes of flexible curing agent appear important: polyamides such as dimerized linoleic acid, polyamide with ethylene diamine, or polyamines with long chains, *e.g.* the Duomeens; amine/thiokol combinations where the terminal thiol groups cure into the resins and polymeric anhydrides such as polysebacic anhydride.

Fillers

Epoxy resins are particularly useful in that they tolerate a very high filler loading and can thus be modified.

Some fillers like talc or silica flour can be used as cheap extenders for the resins, the limits being determined by the physical properties, *e.g.* loss of mechanical properties, but special fillers can also be incorporated. For example, heat conducting resins can be made using silver powder and efficient high energy particle screens by a lead powder — epoxy formulation.

Applications

Epoxy resins are so widely used nowadays that a catalogue of uses could be given and only the large-scale uses for the resins are listed here.

Coatings

The chemically inert nature of the cured resins makes them ideal for protective coatings. Four techniques are employed.

The solution technique uses a solution of the resin mixed with hardener and applied by spraying or brushing and the cure occurs as the solvent evaporates. Subsequent heating is not usually required and hence the use in lining tanks, chemical equipment and so on.

The 100% solids technique utilizes the low viscosity liquid resins with room temperature curing agents. There are no volatile solvents to be removed during cure and coatings produced by this method are free from the minute pin holes which can be present in coatings applied by the solution technique.

A new technique known as the fluid-bed technique is particularly useful. A stream of air is used to keep the solid resin and hardener in a fluid condition and hot articles are then dipped in the mixture; the materials melt on the hot surface and are subsequently cured.

Air drying paints can be formed by esterification of high molecular weight epoxy resins with unsaturated fatty acids. These esters in a solvent such as xylene are then applied as typical paints and air oxidation induces cross-linking forming a solid, coherent surface.

Tooling

Great savings in cost have been achieved by forming tools such as dies, jigs and moulds out of epoxy resins. Liquid resins are employed with polyamine hardeners and usually a filler of ion powder.

Potting, Encapsulation

The low shrinkage on cure, the moisture and chemical resistance, good adhesive and insulating properties and stability to thermal cycling of cured resins, makes them ideal for the encasement of delicate electrical and electronic components such as transformers, armatures, printed circuits and inductors. Lightweight epoxy foams have been developed for such protective purposes.

Adhesives

Since no volatiles are emitted on curing, epoxy adhesives can be employed with application of only contact pressure. The low shrinkage also means that no internal stresses are set up in the joint and the failing loads of joints are correspondingly high. The bonding of metals is particularly effective.

Laminated Structures

The superior adhesion of epoxy resins to glass fibres provides glass-cloth laminates with mechanical properties superior to polyesters, the electrical properties are superior to phenolics and water resistance superior to both. Further, with the variations in resin, hardener and modifying agents that are possible, the properties of the laminates can vary widely.

Moulding Powders

Partially cured resins (B stage resins) and the use of hardeners of low reactivity at room temperature (*e.g.* dicyandiamide) enables epoxy resins to be used for the production of moulding compositions.

Epoxy-Tar Combinations

The upgrading of tar with epoxy resins for non-skid surfaces, the production of repair kits for concrete highways, new roofing materials, decorative laminates and floorings all promise to be large outlets for epoxy resins in the near future.

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Harvard School of Business Graduate Students, 1959.

Monsanto Plans for Polyester Intermediate

A fumaric acid plant with a capacity of 5m. lb. a year is to be built at the Newport, Mon., factory of Monsanto Chemicals Ltd., the company announced this week. It is scheduled for completion in 1962, when it will replace interim manufacturing facilities.

Fumaric acid is an organic chemical intermediate derived from maleic anhydride, also made at Monsanto's Newport factory, where the company's new £1m. maleic anhydride plant recently completed by the Scientific Design Co. Inc. of New York, has been brought on stream.

Logical Supplement

The company says that 'the new fumaric acid capacity will be an important and logical supplement to the 15m. lb. a year capacity of the maleic anhydride plant. These expansions will ensure adequate supplies of both products to cover the forward UK demand and will enable the company to develop and expand its export business'.

Fumaric acid, like maleic anhydride, is principally used in the manufacture of polyester resins, resins for surface coatings, and plasticizers.

Appreciation

THOMAS MARTIN

As reported last week, Thomas Martin, chairman of the Anchor Chemical Co. Ltd., died on March 7. His colleagues at Anchor have written this appreciation.

Tom Martin was a man who will not be forgotten by any who knew him. Combining exceptional business

ability with great kindness and a keen sense of humour, he was respected and loved by all who had the opportunity of working with him.

His success in life was based on a remarkable selflessness of approach, integrity of outlook and quickness of mind, coupled with vitality and keen diligence in pursuing his objectives.

Nearly the whole of his working life was spent with Anchor Chemical Co. Ltd. with whom he rose to be a director in 1923, nine years after joining the company; to assistant managing director in 1941, managing director in 1945 and chairman in 1956. He was indeed one of the chief architects of the continued success of the company.

It was, however, in his personal relationships that he was altogether remarkable. He had a keen concern for the under-privileged. It was typical of the man that right up to the late stages of his final illness, he never forgot to ask about the personal problems and even minor ailments of his staff and their families. His kindness, patience, understanding and fundamental good humour made a deep impression on all who met him.

The memory of Tom Martin will long remain an inspiration and a proof that high morality, unassuming efficiency and a kindly sense of fun combine to make an outstanding businessman.

Rubber Reclaiming Processes

UNIFORMITY OF PRODUCTS A PRIMARY REQUIREMENT

THE selection of a process suitable for the large scale reclaiming of waste rubber depends upon economics, on plant available, and to some extent upon the nature of the waste material. Of the many processes which have been devised only a few can stand the test of modern requirements — high productivity, low unit cost and the ability to cope with the increasing proportions of SBR used, either blended with or contiguous with natural rubber, in tyre construction.

Whether the reclaiming procedure involves dry processing at high temperatures, described by W. A. Tandy (North Western Rubber Co. Ltd.) or digestion with an aqueous solution, dealt with by W. Salisbury (North British Rubber) in a recent lecture series at the National College of Rubber Technology, uniform penetration of the particles of rubber by heat or by a reagent is an essential feature. This emphasises the importance of the preparatory processes of grinding, screening and cleaning to produce crumb of suitable and uniform particle size and adequately blended to yield as nearly as possible uniformity of composition.

Sorting of Scrap

Although general sorting of tyres is performed by scrap merchants, further examination is done by the reclaimer who strives for uniformity by drawing from various dumps in set proportions, a procedure which necessitates the storage of upwards of 5,000 tons of scrap. Tyres may be cracked with or without beads according to size and equipment available. During mechanical conveyance, the coarse crumb is freed from bead wire and large pieces of fabric, and is then screened before entering the nip of a fine grinding mill. After each pass through the nip the crumb travels over a finer vibrating screen but only some 10-15% passes through.

A large quantity of crumb is in cycle at one time and this constitutes a further blending operation, making for uniformity in the product. A typical grinder has rolls 26in. x 30in. face, a friction ratio of 5 requires a 250hp motor and produces about 150lb. per hour of graded crumb consisting of mixed rubber and fibre. The preferred particle size varies according to the details of subsequent processing but must be smaller for material containing SBR.

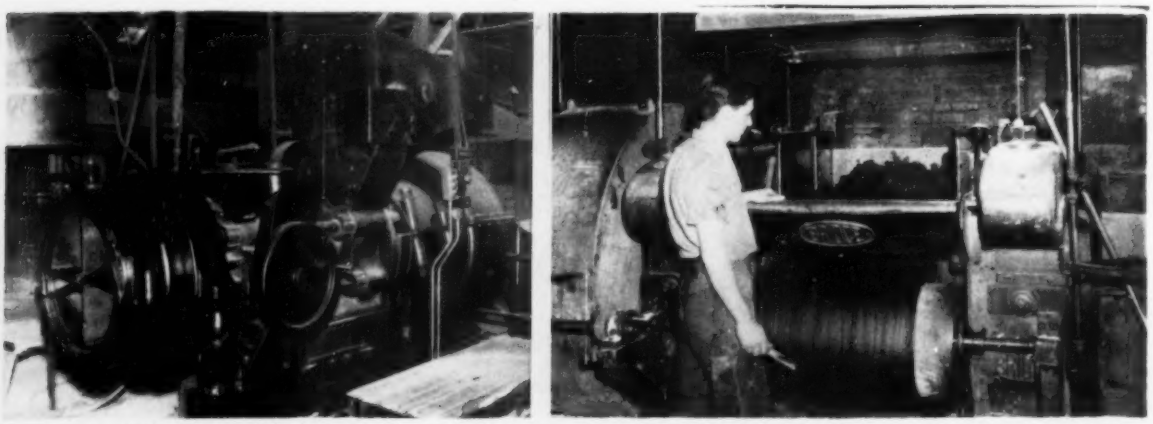
In all processes, the fabric must be destroyed and the rubber must be plasticized by the joint action of swelling agents and heat. The swelling agents include relatively volatile light paraffinic oils derived from petroleum which cause rapid swelling but are lost during heating and so are absent from the final reclaim. Their function is to facilitate the permanent swelling produced by the action of heavy non-volatile petroleum oils and coal tar pitch which are the true plasticizers. Sometimes light terpenes and intermediate petroleum oils are included in the blend. The amount of oil used depends on the plasticity desired in the product but a typical batch requires 5% or more.

The use of chemical peptizers appears to be controversial. Whereas Mr Tandy said a peptizer of the dicresyl disulphide type was used in preparing material for treatment by the dry processes, Mr Salisbury contended that in natural rubber reclaims made by the digester processes peptizers were of little value. For successful use in material containing SBR a peptizer must preferentially attack the less tractable SBR phase, but known peptizers preferentially soften the natural rubber so that they tend to emphasize the different permeabilities of the two phases. Indeed when attempting to reclaim tyres built with SBR side walls and natural rubber tread the difference is so great as to produce a 'putty and marbles' effect in the product. In view of the trend towards greater proportions of SBR in tyre scrap it seems that there is scope for research aimed at the discovery of new peptizer types, which must be cheap if they are to interest the reclaimer.

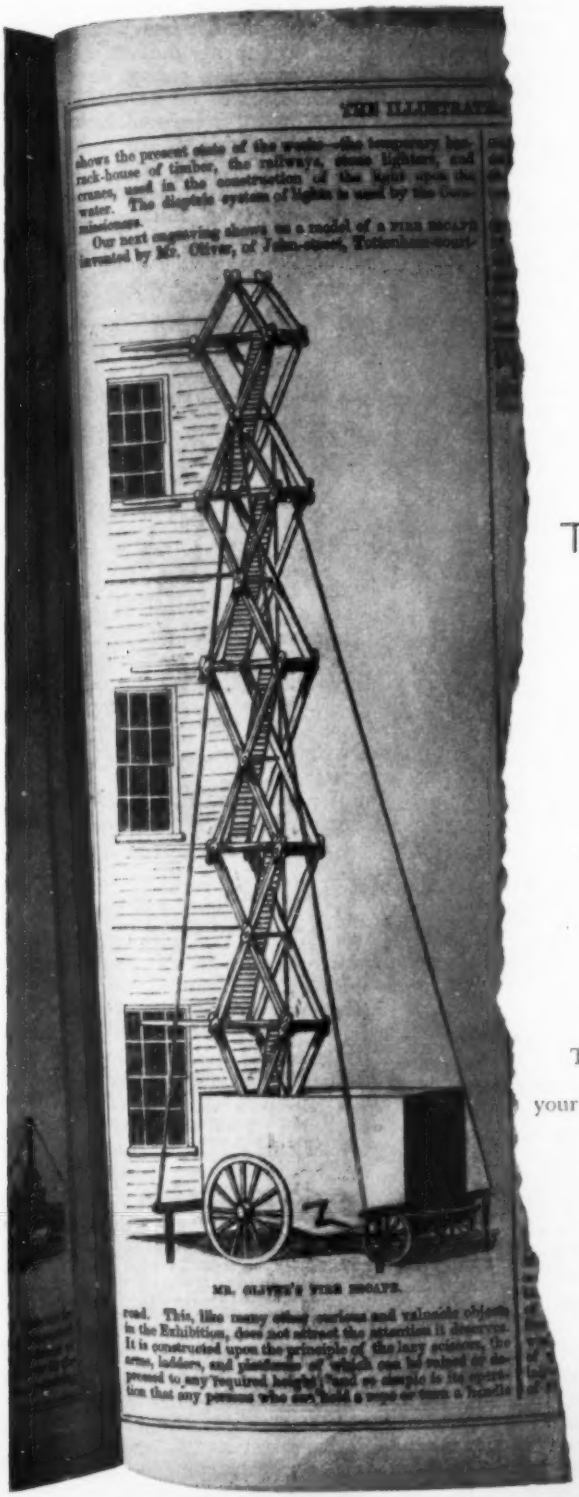
The major differences between the various processes lie in the mode of treatment aimed at destruction and disposal of the fibre.

The Engelke Process

The pre-blend of crumb and oils is packed in wire baskets and heated in a large autoclave supplied with saturated steam at pressures up to 800 psi giving a temperature of about 575°F. The use of superheated steam gives risk of explosion and a less satisfactory reclaim. During the 20 minutes heating the fibre is carbon-



Two stages during the reclaiming of rubber are straining to remove fine particles of foreign matter shown on the left and refining and leaf sheeting which removes hard nibs and improves plasticity



THE ILLUSTRATED

shows the present state of the works—the temporary barrack-house of timber, the railways, steam lighters, and cranes, used in the construction of the forts upon the water. The diagonal system of lights is used by the Commissioners.

Our next engraving shows us a model of a FIRE ESCAPE invented by Mr. Oliver, of John-street, Tottenham-court-

MR. OLIVER'S FIRE ESCAPE.

road. This, like many other curious and valuable objects in the Exhibition, does not attract the attention it deserves. It is constructed upon the principle of the lazy scissors, the arms, ladders, and platforms of which can be raised or depressed to any required height, and so simple is the operation that any persons who can hold a rope or turn a handle

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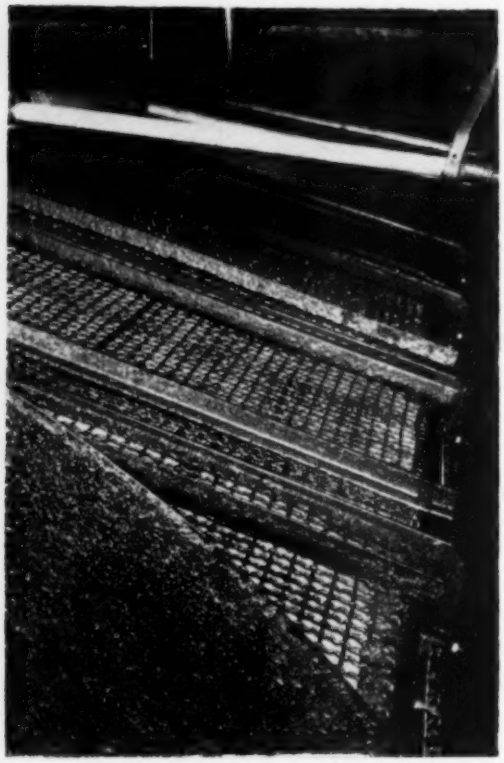
ized and ultimately becomes dispersed in the rubber, giving 100% yield.

The soft 'cake' is broken, strained and finally mill-refined in two stages to remove fine particles of foreign matter and hard nibs and also to increase plasticity.

This process is the most rapid used in the UK. By adjustment it can yield reclaim of any plasticity, even almost liquid rubber. It is also applicable to nitrile and butyl rubbers but it tends to produce an unpleasant odour in the exhaust steam which must therefore be scrubbed or passed into a water trap.



After each pass through the grinding mill the crumb passes over a finer vibrating screen but only 10-15% passes through

The Reclaimator Process

Developed in USA, this is the only continuous process in current use. It consists in the mechanical removal of the fibre from the crumb and the subjection of the rubber to thermal shock. Spiked rollers are used to tear the fibre to fine particle size and hammer mills to crush the material while air is employed to blow off the fibre. The crumb is graded by screening, passed over a magnetic separator to remove metal and then to an air floatation table where stones etc. are removed.

The cleaned graded crumb is blended with oils and peptizers in a continuous process and is then passed to the reclaimator itself. This is a modified extruding machine. The barrel is temperature zoned and the screw is designed to produce highest pressure about half way along. The combination of high rate of shear and high temperature (550°F.) gives very rapid reclaiming — in some cases in as little as three minutes. The 6in. machine gives an output of 300lb./hr. and the 12in. size can produce nearly 1,500lb./hr. It is claimed that only one refining pass is necessary.

The process is claimed to be effective with SBR although plasticizer and peptizer contents are increased. In handling mixtures of SBR and natural rubber the hardening of the SBR must be balanced against the softening of natural rubber and if the heating period is excessive the product may resemble soft coke.

Digester Processes

A digester must be sufficiently robust to withstand steam at 250 psi and was originally built in spherical form supported on trunnions through which steam was admitted. It was rotated at 4 rpm and handled 1,000lb. of crumb at a charge. For modern conditions a normal charge is 9,000lb. which is treated in a stationary jacketed cylindrical vessel. The crumb is covered with water containing either five parts dry sodium hydroxide or three parts calcium chloride or zinc chloride per 100 parts crumb, and the charge stirred throughout the five hour's heating in steam. The spongy product is washed and dehydrated by passage through an extruder with perforated barrel. Water content is reduced from 25% to not less than 3% in a countercurrent or rotary drier and the crumb is ready for the internal mixer. Here it is consolidated, further plasticized and may receive fillers and/or further plasticizers in order to bring its properties in conformity with a specification.

A 10in. strainer is employed to clean the product which then passes to a 36in. refining mill whose front roll speed is 228ft./min. and whose friction ratio is 2.5. The use of cambered rolls causes hard nibs to pass to the edges where they are removed as 'tailings,' some of which can be reprocessed. The second pass refiner is set at 0.004in. and from this the reclaim is removed and wrapped on a drum. Slabs about 100 plies thick are cut off and cooled before stacking to minimize fall of Mooney viscosity during storage.

The addition of activated carbon to the internal mixer absorbs residues of antioxidant etc. in the production of non-staining grades of reclaim. Staining components can also be broken down by the introduction of formaldehyde to the digester, shortly before the end of the heating period.

Effects of SBR

The increasing use of SBR in tyre manufacture has led reclaimers to give preference to the neutral rather than the alkali process which is less effective with synthetic materials. Finer grinding is necessary and steam pressures exceeding 250 psi are preferred. Wear on machinery is heavier when SBR stock is processed — refiner rolls must be re-cambered twice as frequently. This has increased maintenance costs markedly and is one of the major reasons why reclaiming processes continue to be operated batchwise rather than continuously.

Fast Switching Device

Radyne HF welding generators, with what is claimed to be a newly developed electronic switching device, are being used to weld packaging bags at speeds of 150 welds per min. Several bags can be welded in one operation, depending on the size of the bags, and pvc, nylon and other material can be welded.

The fast switching device, coupled with an arc sensing unit which avoids shut downs on fully automatic plant, can be applied to new or existing presses.

AMERICAN LETTER — from Norman L. Hewitt

Conflict in Flexible Foam Field

FALLING CONSUMPTION OF PVC FOAM

ALTHOUGH the tripartite conflict among natural, urethane and pvc flexible foams in USA has yet to produce an acknowledged champion, the cause of pvc appears to be all but lost. Consumption statistics of foam cushioning in 1960 showed a weak 1.1m. cu. ft. of pvc against 36m. of natural latex and 47m. of urethane. (On a weight basis natural still leads urethane, two to one.)

The only pvc foam of any commercial importance has been that produced by the Elastomer Process. Now Union Carbide, who purchased the Elastomer Chemical Corp. in 1958 and licenses the process to other manufacturers, has curtailed production to a considerable extent. Lacking any definite word, one can only speculate that the material's admittedly poor compression set characteristics are proving to be an intolerable obstacle. In a paper published two years ago Casey and Rogers (Union Carbide Plastics) reported pvc set values 5 to 7 times greater than those of natural or urethane foams in the standard test of 50% deflection for 22 hours at 70°C. High costs have also been working against pvc.

Urethane Marketing

Meanwhile, urethane advances steadily. Aided by high natural latex prices and the advantages of the polyether one-shot process, US consumption reached 100m. lb. (rigid included) in 1960. In addition to securing a greater share of the established foam uses in upholstery and bedding, flexible urethane has made a strong and unique entry into the clothing industry. Urethane coat and jacket linings are as warm as wool, lighter, and of less bulk. They are particularly well adapted for use in the more imaginative women's fashions.

This year the clothing industry is expected to consume 2.5m. lb. of urethane foam. Most of this will go into bulky coats and outer wear jackets, replacing cotton and wool. These linings are sliced to a thickness of 3/32in. for winter garments, 5/64in. for spring models. Adhesion of foam to fabric is obtained by a flame bonding technique although some adhesives are also used.

The coming market for urethane foam has been thoroughly examined by P. B. Nortman in *Plastics Technology*. He notes that the costs of raw materials, especially toluene diisocyanate, are decreasing continuously. The new closed-mould process — on the verge of widespread adoption — will overcome the 25% scrap losses now sustained in trimming the open-moulded bread top slabs. The resulting lower production costs will provide a widening economic advantage over the natural product. Latex foams' only competitive recourse is increased use of SBR and fillers, and it is not likely that this can offset urethanes present strong and ever-strengthening position.

Possibly the major urethane question is not technical at all, but one of marketing. Will the job of advertising, promotion and merchandising be undertaken by the raw material producer, the foam manufacturer, or the laminator and makers of finished articles? In the raw material group the isocyanate producers are: Mobay, Du Pont, and Allied Chemical; (Nopco will soon be producing). The polyol producers include Jefferson Chemical, Union Carbide, Dow, Wyandotte, and Atlas Powder. Foam makers now number about 50. (In the clothing field, Scott Paper and Reeves Bros. have the majority of the market.) When some unanimity of selling function is reached among all these companies — and the finished article men — urethane foam will be ready to move with real authority into the cushioning field; ultimately, the challenge will be not so much to rubber as to the old incumbents: cotton, sisal, and hair.

Rockets and Rubbers

The specific impulse rating of rockets propellants is calculated from the difference between heats of combustion of gases in the rocket chamber and at the exit nozzle of solid propellants. The SI of solid propellants are in the 240/250sec. range; the best liquid systems have a 400sec. value.

The present goal of research on solid systems is a specific impulse of 300sec., and it is likely that the compounds which will attain this level will be based on polymeric binders. But reaction power is only the first requirement to be met in a solid propellant. Freedom from voids, shrinkage cracks, and poor adhesion are basic to proper functioning of a solid system.

New Terminology

Thiokol liquid polysulphide has been the first and most used solid propellant binder, but of late the technical Press releases are filled with the achievements of a number of less common polymers.

The Rocketdyne Division of North American Aviation Inc. produces a carboxy terminated linear polybutadiene known as Flexadyne. In addition to dimensional stability over the −75° to 175°F. temperature range, it has good ageing properties. Flexadyne has been used in 10in. diameter rocket motors containing 120lb. of propellant, and in 26.5in. motors containing over 4,000lb. Recently, Rocketdyne announced the firing of a 36in. diameter solid propellant motor at a temperature of −75°F. The military importance of a weapon operable at such a low temperature is obvious.

Solid propellant materials of the Grand Central Rocket Company (Redlands, California) include three basic types of binder; polybutadiene-acrylic acid copolymers, methyl vinyl pyridine, and cellulose acetate. A new term, 'nitroplastisol,' is used to describe mixtures of pvc and oxidizers such as ammonium nitrate and ammonium perchlorates. Aerojet-General Corporation is also reported to be working on this type.

Fringe Benefits

Recent wage and contract settlements in the rubber industry illustrate the present emphasis on fringe benefits. The United Rubber, Cork, Linoleum, and Plastics Workers' Union obtained concessions involving hospitalization, pensions, vacations, and jury duty. Actual wage increases have been in the range of 5-6 cents per hour. American Hard Rubber Co. of Butler, New Jersey, reached a welfare agreement which increased hospitalization benefits from $14 per diem for 70 days to $18 for 120 days.

Dryden Rubber, of Chicago, agreed to provide full pay (less jury fees)

for employees called to serve the usual two weeks of jury duty. Vacation benefits were broadened to two weeks for four years' service and four weeks for 25 years' service. A concession to management was the elimination of the cost of living escalator clause which, at the present rate, provides an automatic wage increase of 1 or 2 cents per hour each year.

Plastics Industry Statistics

That old warhorse polystyrene put on a burst of sales speed in the 1960 stretch to attain a virtual three-way dead heat with polythene and the vinyls in the plastics production race. All three passed the one billion lb. mark. Polystyrene's achievement required a 5% increase over 1959; polythene's 12% helped retain its slight margin as leader. The plastics industry's total production in 1960 is made up as follows:

	m. lb.
Polythenes	1,350
Vinyls	1,213
Polystyrene	1,026
Phenolics	594
Urea and Melamine	403
Polyesters	192
Celluloses	145

Although these figures represent a 5% gain over last year, optimism was restrained. In 1959 an economic survey of the Society of the Plastics Industry reported only 4% of some 400 replying members felt that business was 'poor,' with 30% in the 'excellent' class; this year the 'poors' rose to 22% while the 'excellent' group declined to 14%. In the specific area of thermosetting moulding (industrial rather than consumer items) a production decrease of 10% was reported. Generally, as in the rubber industry, volume was higher and profits lower.

Record Tyre Shipments

Manufacturers' shipments of passenger cars tyres during 1960 amounted to almost 105,800,000 units, the highest recorded shipments in the history of the tyre industry. This represents an 8.6% increase over the previously recorded high of 97,400,000 tyres shipped during 1959. A sharp increase of 22% in original equipment shipments contributed to this new record high. Replacement tyre shipments during 1960 also increased, amounting to 68,534,890 units, 2.54% higher than the comparable figure of 66,840,236 tyres for 1959. A new high for production was also reached with a total of 105,361,431 tyres recorded for 1960, a 2.6% increase over the previous record high of 102,695,694 units produced during 1959, according to the Rubber Manufacturers' Association Inc.

Much of this increase is attributed to the splendid sales record of the compact models. Thus, in the truck and bus tyre types, where compacts were not a factor, a decrease in shipments of 7.7% below last year's figures was reported. Production in this category also was down, and the year ended with an increased inventory of 18%.

The situation which is unfolding in the first months of 1961 holds little promise that the 1960 record will be broken — or even equalled. New car sales have been lamentably slow, and one after another of the car plants have curtailed production schedules or completely stopped assembly lines for short periods.

A Retread Development

Retreading of worn tyres often appears to lie somewhat beyond the irregular boundaries of the rubber industry. The retreading shops are not listed in the pages of the *Rubber Red Book*, they seldom employ chemists or technologists, and their industry associations and Press are quite separate from the well-known groups devoted to elastomer matters. Yet there are few better illustrations of the properties and performance of rubber-fabric composites than those to be found in the retread shop.

Evidence that retreading also has its research achievements is offered with the recent announcement of a new anti-skid tread. A retreading concern in Monsey, NY, was the scene of the first trials of a tread additive developed by Dr L. W. Tomarkin, a physician who has worked at the problem of winter traction for the past ten years (certainly a very real problem for a country doctor).

Dr Tomarkin's additive is an elastomer based compound supplied in the form of tiny cubes. These cubes are dispersed in a regular tread stock. Vulcanization produces a permanent bond to the tread compound and forms a tread surface of mottled hard and soft areas. These alternating areas — or more likely the boundaries between them — provide a traction which surpasses that of conventional snow and anti-skid tread designs. Various mobility tests conducted by the Atlas Supply Company have rated the new tread from 30 to 67% better than the standards. Skidding on ice was reduced 15%.

The basic idea of introducing hard particles into a regular tread to improve traction in snow and ice is not new. Sawdust, oyster shells and nutshells have been tried and discarded because of the twin defects of lack of adhesion and loss of abrasion resistance. Some success has been gained from hardwood cubes, currently in use by a New England tread supplier. At least one patent (US 2,690,461, September 1954) describes the use of hard rubber particles the size of grains of sand. The hard-to-soft-rubber bond overcomes the adhesion problem and abrasion is reported to be unaffected. Hard rubber is thus a possible forerunner of Dr Tomarkin's material.

The process and additive composition has been licensed to the Atlas Supply Company, for whom US Rubber will manufacture tyres as well as tread (camelback), and in Canada to the Dominion Rubber Company Ltd.

The Elastomers Market in 1960

The steady yearly increase in new rubber consumption in the US halted in 1960 with an unpredicted drop of almost 5% below the 1959 high of 1,627,770 long tons. Most of the loss came from a reduced natural rubber consumption, to 479,000 from 555,000. Reclaim also fell, and among the synthetics, domestic buying was less for all but SBR. However, increased exports of neoprene and butyl of 20 and 30% respectively allowed modest production increases for these elastomers. The results for total synthetic production were 1,076,000 long tons, a new high which gave a synthetic-to-natural ratio of 69.2% to 30.8%.

Tyres in Parliament

A question was asked in the Commons this week on the trading attitude of the motor tyre industry since its investigation by the Restrictive Practices Court.

In a written answer the President of the Board of Trade said that the Registrar of Restrictive Trading Agreements had started proceedings concerning two registered agreements over the sale of motor tyres. But the hearings before the Restrictive Practices Court were unlikely to take place for some time, he added.

He had been asked what evidence he had that the trade was tending more towards monopolistic practice. It would be wrong to comment on this at the moment, the Minister said, as the matter was *sub judice*.

Rediweld Take-over

Rediweld Ltd., of Crawley, a member of the Rediffusion Group, has taken over Glass Fibre Developments Ltd., Peacehaven.

The company says that this move has been taken in order to increase production facilities for glass-fibre reinforced plant and equipment.

A CROWNING ACHIEVEMENT

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Engineering Aspects of Acetal Resin

PLASTICS IN AUTOMOBILE APPLICATIONS AT DU PONT SEMINAR

THE interesting engineering possibilities of the recently-introduced acetal resin Delrin were illustrated at a seminar arranged by Du Pont Company (UK) Ltd., in London last week (*RPW*, February 25, 319).

This very well organized function was attended by over 100 representatives of the British motor industry and one of the principal speakers was J. D. Young, manager of Automotive Development, Detroit, for the Polychemicals Department of Du Pont. His talk was called 'New and coming applications for plastics' and after a brief review of the development of usage of plastics in the American motor industry over the last few years, he described, with the aid of a set of very fine coloured slides, some of the applications for plastics in today's automobile.

The wide acceptance of Delrin by US motor manufacturers is illustrated by the mouldings shown. These include the Valiant instrument cluster housing, carburettor components, a steering ball seat bearing, cable pulleys, lamp holders and door handles, all of which are being used on 1961 models

A Year of Progress

Delrin acetal resin was introduced commercially in the US just over a year ago, following more than three years' development to establish applications for this versatile material. The motor industry, he said, was especially interested in Delrin because it was the first thermoplastic with the necessary strength at elevated temperatures to be considered for applications where previously only metals could serve. Tests carried out in the Arizona desert had shown that engine compartment temperatures could rise as high as 250°F., while interior body temperatures of up to 220°F. were recorded. The strength of Delrin at such temperatures was sufficient to permit its consideration for applications such as carburettor and fuel pump components, instrument cluster housings which must support a heavy load and other uses previously served by die cast or stamped metals.

Other advantages obtained by the use of a thermoplastic included a considerable saving in weight and the simple production methods which eliminated costly finishing operations.

The low coefficient of friction of the material made it of interest for bearing surfaces in steering and suspension joints, and, since the static and dynamic coefficients were equal, slip-stick problems were not encountered.

Instrument Housing

One of the most outstanding examples of the use of Delrin, and one of which Du Pont are justly proud, is that for the 1961 Chrysler Valiant instrument cluster housing illustrated on this page. This was, until very recently, the largest moulding which had been made from Delrin and represents a major development in the use of a plastic in place of a metal. The Valiant housing weighs 2lb. and replaces a 7lb. zinc die casting which emphasizes the weight and cost savings inherent in the material.

The evaluation of Delrin for this particular moulding was described by R. G. Richardson, and while the tests carried out were deliberately severe, the results were entirely satisfactory. The confidence amassed by this development has helped to establish Delrin as an engineering material and another larger moulding was produced at the seminar which comprised an almost complete dashboard, housing not only the numerous instruments and controls, but the radio and glove box as well. The intricacy and quality of this injection moulding served to emphasize both the engineering possibilities of the material and its ease of fabrication.

Other Materials

Although Delrin is the latest addition to the Du Pont stable and therefore stole the limelight, uses of other plastics were described by Dr G. F. C. Barrett. Lucite acrylic resins, he said, were finding increasing favour for decorative and lighting applications. Another recently introduced material was a specially developed grade of hydrolysis resistant nylon, designated Zytel FE-2281, suitable for use in cooling systems and for car heater components. Teflon 100 was a new fluorocarbon resin combining most of the advantage of ptfe with the ability of being fabricated by the methods used for conventional thermoplastics.

It was essential, however, said Dr Barrett, that more emphasis be given to the training of engineers in the use of the plastics materials which were assuming an ever-increasing importance in our lives today.

PI News

Education and Training

Registration forms are now available for the Plastics Institute conference on education and training in the plastics industry to be held at the Institution of Electrical Engineers on June 19 and 20 1961.

Technical Committee

The new technical committee of the Institute held its first meeting recently when Dr C. L. Child, BSc, PhD, API, was elected chairman.

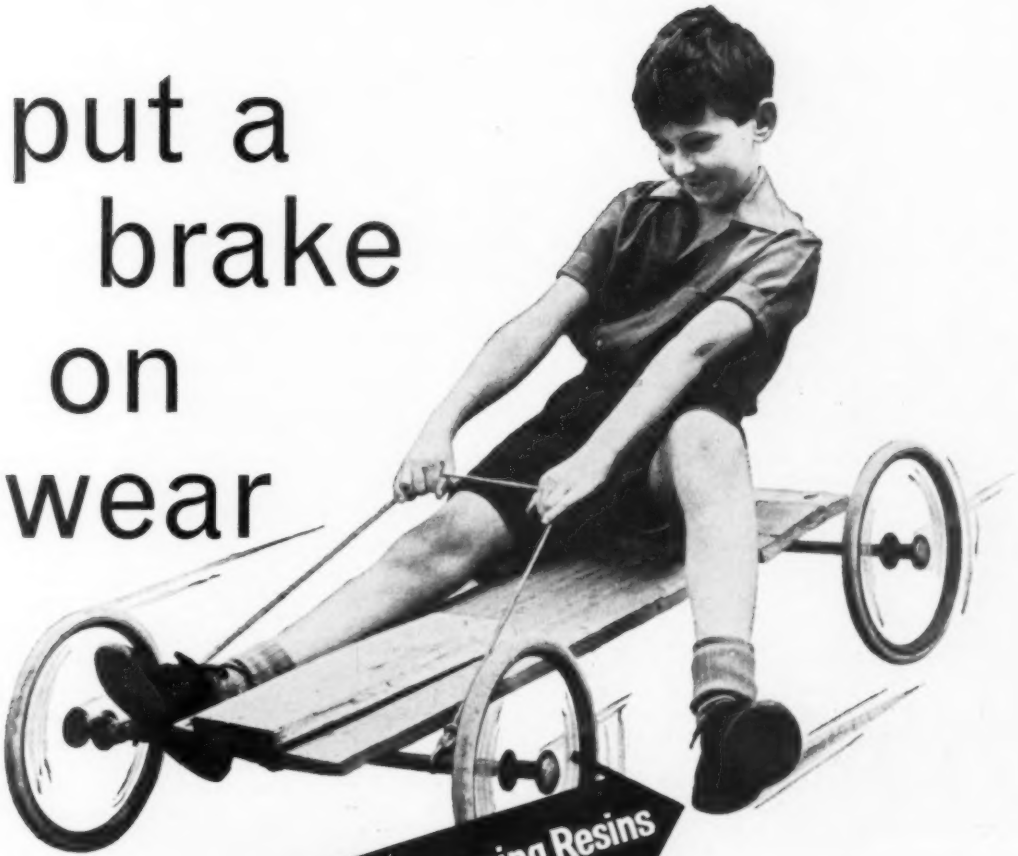
Examination

The Institute has received 162 applications for the 1961 examination, ten more than last year.

Awards

The council of the Institute has made the following awards: fellowship: S. F. Chancellor, BSc, FRIC. Associateship: P. R. Bloomfield and F. B. Ward.

put a brake on wear



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RAPID EXPANSION OF REINFORCED PLASTICS GROUP

FOR the second year in succession the section of the British Plastics Federation which has increased most in numbers is the reinforced plastics group, the membership of which has increased to 67, making it the third largest in the federation. This information is contained in the 1960 annual report of the Chairman and Council which was issued this week at the annual general meeting.

The total membership of the federation increased from 293 to 303 during the year. There were 17 resignations, mainly in the fabricators group where the situation in the cable industry has continued to influence membership, but this was offset by the election of 27 new members.

Research

There was much activity during the year in connexion with the proposals for the establishment of a research association, says the report. This culminated in the change of name of the Research Association of British Rubber Manufacturers to the Rubber and Plastics Research Association and the adoption of new articles of association. The new association came formally into being on January 1 1961, with a founder membership of 70 companies in the plastics group.

Initial discussions also took place during the year on research projects undertaken by technical colleges and universities in relation to the plastics industry. The BPF hopes that arrangements can be made in the future for such educational establishments to be more accurately informed through the Federation of those lines of enquiry which would seem to the industry to be the most important at any time. Liaison with the Plastics Institute is being maintained in this matter.

Overseas Trade

There has been much activity in the field of overseas trade under the control of the overseas trade committee of the council. A study of world trends in plastics materials has produced interesting, though somewhat disturbing results, and it is intended to prepare a short report for members.

With the emergence of EFTA in July, members were faced with new problems, both of growing competition from other countries and of other administrative details, and the Federation has maintained close contact with the Board of Trade and Customs and Excise on such matters and has assisted members with their problems.

The importance of close liaison with the other plastics associations in Europe has been recognized; steps to achieve it began with a meeting in London in February of representatives of the plastics associations of EFTA countries (*RPW* February 25, 282).

Technical Work

Technical work continued to be one of the main activities of the Federation under the auspices of the main technical committee. During the year new sub-committees were set up to prepare specifications for WC Flushing Cisterns and for Acrylic Sink Units. A specification for Unplasticized pvc Pipes for Cold Water Services was submitted to the BSI for consideration as a draft British Standard.

The possible adoption of the metric system in future standards published by the ISO was discussed and a code of practice published for the application of aqueous dispersions of ptfe.

A diagram attached as an appendix to the report shows that, apart from its eight sub-committees, the main technical committee has 15 committees springing from it, which in turn give rise to 15 technical sub-committees. This gives a good idea of the thoroughness with which the Federation's wide field of responsibilities is covered.

New members of the British Plastics Federation in the period covered by the report were: Britiona Ltd., W. A. Mitchell and Smith Ltd., Betterwear Products Ltd., The Essex Mica Co. Ltd., Initial Plastics Ltd., Laughton and Sons Ltd., Rosite Ltd., A. B. Plastics Ltd., Marley Extrusions Ltd., Pressed Steel Co. Ltd., Tough Plastics Ltd., Troman Brothers Ltd., Parnall and Sons Ltd., West Instrument Ltd., The Anchor Chemical Co. Ltd., Croxton and Garry Ltd., Durham Chemicals Ltd., Ferro Enamels Ltd., Howards of Ilford Ltd., Whiffen and Sons Ltd., Acrow (Reinforced Plastics) Ltd., S. Bourne and Co. (Plastics) Ltd., British Transport Commission, Jas. C. Cuncliffe Ltd., Palmers Reinforced Plastics Co. Ltd., C. F. Taylor (Plastics) Ltd., and C. L. Whitaker (Reinforced Plastics) Ltd.

New associate members during the same period were: The Geigy Co. Ltd., H. Muehlstein and Co. (London) Ltd., Rubber Regenerating Co. Ltd., and Wickman Ltd.

ASEE Exhibition

CABLES SWITCHGEAR AND INSULATORS

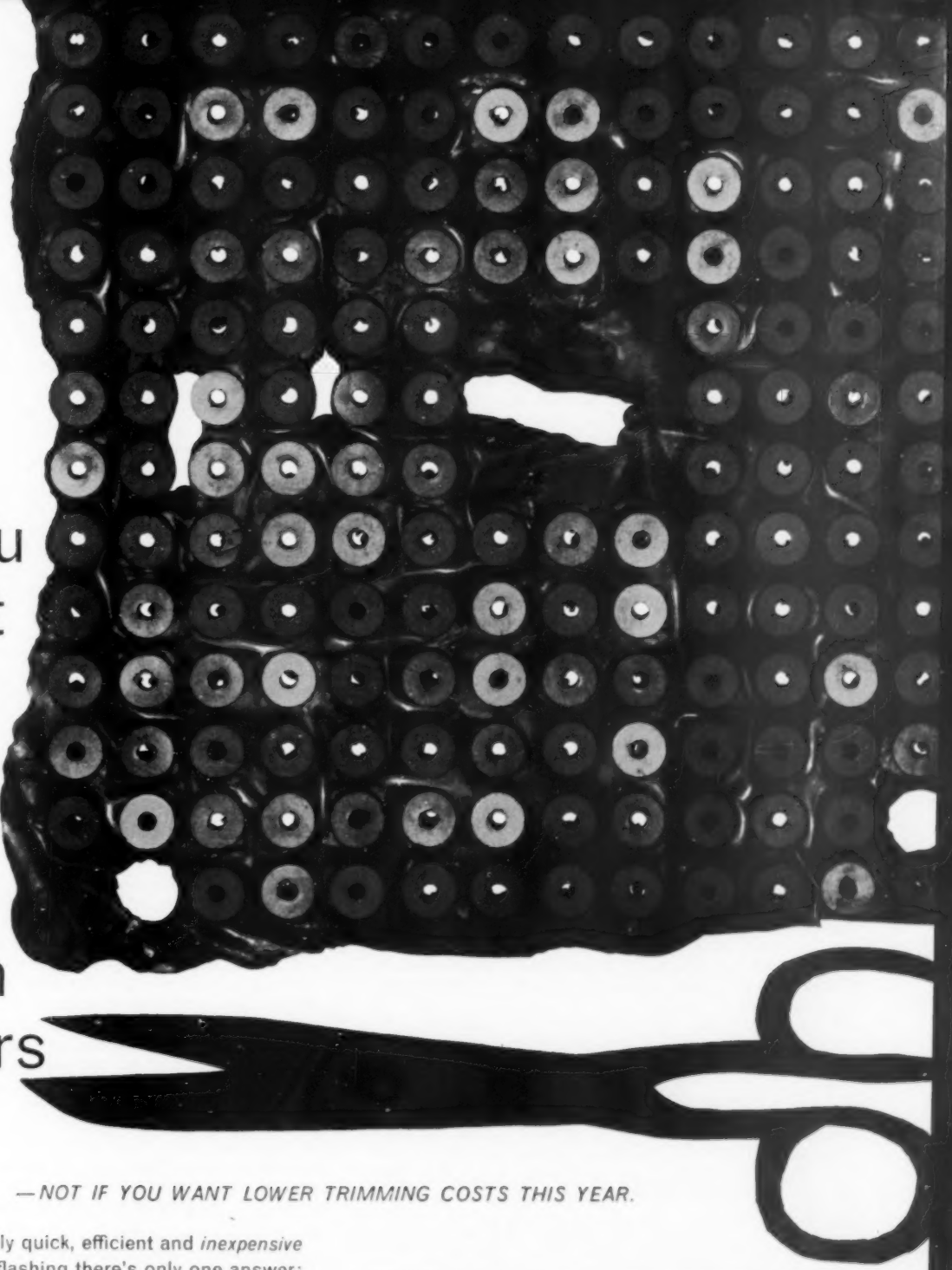
FEATURED in the power cables display of British Insulated Callenders Cables Ltd. at the Electrical Engineers Exhibition, which opens at Earls Court on March 21, will be a showpiece incorporating a sample of the new 100kV. DC single-core submarine cable to be laid on the bed of the English Channel as part of the power link between the national grid systems of Britain and France. In addition a range of pvc and polythene insulated cables, recently developed cable glands, and specially toughened butyl rubber insulated nr/pvc sheathed cables for road heating will be shown.

Among the exhibits on the I.C.I. stand will be a variety of electrical components made from Fluon ptfe. Melinex insulated wire used in transformers, cables with a Melinex core binder and a range of new silicone products will also be shown.

A display of switchgear components, bushings and other large electrical components cast in Araldite epoxy resin will be the main feature of the Ciba (ARL) Ltd. stand and there will also be many examples of other uses of epoxies in the electrical industry including potted transformers, laminated structures and coated components.

Permali Ltd. are displaying two forms of glass fibre reinforced materials for the first time: wave wound tube for arc control pots and conduit, available in diameters up to 6ft. and lengths of 20ft. and extruded glass fibre rod for use in stay wire insulators and whip aerials.

The latest developments in plastic power cables and accessories included in the exhibit on the Aerialite stand will be cable jointing systems and a complete range of sealing and non-sealing glands.



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VIEWS and REVIEWS

Adhesion of High-polymers

IN the February 1961 issue of *Adhesives Age* (Vol. 4, No. 2, p. 62) J. J. Bikerman writes a critical review of a Russian book by Prof. S. S. Voyutskii called 'Autohesion and Adhesion of High-Polymers'. The theory advanced in the book is that autohesion — the sticking together on contact of two pieces of the same semi-solid material, as in rubber tack — and also the adhesion of one high-polymer to another are caused by 'mutual interpenetration of the two bodies, that is interweaving of the chains which belong to two different solids'.

Bikerman concedes that 'there is no doubt as to the existence of this intermixing in many adhesive joints between two identical or different plastics or elastomers', and I like his ironic comment that this theory therefore 'reduces adhesion to an existing phenomenon . . . a relative advance over some older hypotheses which attributed adhesion to phenomena which do not exist at all'.

He points out, however, that there can be other explanations of the facts. Voyutskii's diffusion or interpenetration theory (which is surely not new) is based on the observations that the breaking stress of the joints under examination increased with time, pressure, and temperature, 'all factors known to enhance the inter-mixing of two plastics or elastomers'. Other explanations include the gradual elimination from the joint of air or solvent. Nor must it be assumed that 'the breaking stress of an adhesive joint gives information on the strength of the adhesive bond; in reality, in many instances, the strength of the adhesive material is being measured'.

The reviewer points out that the theory cannot account for adhesion between polymers and metals or glasses, and he deplores the absence of quantitative predictions from it, which could be calculated from the diffusion coefficients of chains and chain segments.

Sticking the Unstickable

There comes a time in the life of nearly every technologist when he wants to have his cake and eat it; commonly in our group of industries it takes the form of finding an extremely inert and unreactive material and then wishing to stick it to something else. Examples are the halogenated hydrocarbons such as ptfe, Teflon, Kel-F, and Viton.

An article by H. W. Arnold in the February 1961 *Adhesives Age* supplies an answer to the problem. Under the title 'Etchant Makes Teflon Adhesionable . . .' it describes a proprietary 'etching solution, known as Tetra-Etch and manufactured by W. L. Gore and Associates, Newark, Del., which reacts with fluorocarbon resins to produce a carbonaceous surface film which serves as a medium for tightly bonding. . . .' The solution contains metallic sodium and the vehicle is a powerful but inflammable solvent. An epoxy primer is often found advantageous on the surface of the 'etched' Teflon.

Measurement and Control of Flow

Increasing automation in our industries, coupled with the discovery of more powerful catalysts and accelerators, is raising the problem of accurately measuring continuously, and even regulating the flow of small quantities of liquids. This field, of growing importance, is reviewed by Sterling and Ho in *I/EC* for February 1961, Vol. 53, No. 2, pp. 51A-55A.

Capillaries can be drastically impaired by dirt or deposition, and orifices easily erode. Dirt has a deleterious effect on the valves of pumps, which are commonly used as positive-displacement meters for small flows. Gear pumps can be quite accurate, providing the viscosity and the differential pressure are suitable.

'Peristaltic or squeeze-type pumps which have the advantage of being valveless . . . operate by mechanically squeezing a plastic tube so that an entrapped length of fluid is forced out'. They do not easily maintain regular deliveries owing to compression set in the tubes, and sometimes to temperature variations in the liquid being measured.

Automated hypodermic needles are perhaps best suited for laboratory work. Low viscosity liquids may be dispersed at very low rates from a closed reservoir containing an inflatable sac. Displacement of one liquid by another liquid, for example, mercury in a capillary, can give a very uniform rate of slow flow.

The rotameter is perhaps the best known meter of flow; it covers a wide range of the commonest rates of flow. It is easily affected by drag on the float caused by, for example, high viscosity or dirt on the float, and it must be carefully calibrated before use with an unknown liquid.

Electromagnetic Flowmeters

Electromagnetic flowmeters, which would seem *a priori* to be ideal, are, in some circumstances, limited by polarization of electrodes at the low emf of small rates of flow. Turbine and paddle-wheel meters are useful for the higher rates of flow but care must be taken to check the linearity of their response.

The article discusses other specialized types of flowmeter and has a chart depicting the ranges of flow rates from 0.01 to 1,000ccs. per minute of gases and liquids covered by the various types of flowmeters, but it concludes with the opinion, which I think is shared by most laboratory and process technicians, that there is a 'lack of suitable hardware . . . pressure regulators, valves, flow controllers, and transducers for low flows'.

Handling Materials

A twelve-month's review of progress in the handling of materials is given by J. R. Arwood in *I/EC* for February 1961 on pp. 159-160.

The cost of handling materials is a large part of the total labour cost in most industries, although it adds nothing to the value of the product. The author rightly pleads for more fundamental, theoretical studies of the problems, but most of his review is inevitably concerned with developments in equipment, such as improvements in fork trucks, drum handling, accuracy combined with speed in weighing, air conveying systems and air-operated packers.

The author makes the valid point, when discussing bulk handling, that the system must be devised as a whole; components, such as containers, should not be designed in isolation.

COMMENT ON SCIENTIFIC AND INDUSTRIAL MATTERS

by **F. C. JENNINGS**

Process Control and Automation

Also in this February 1961 issue of *I/EC*, on pp. 166-8, is an annual review of progress in the field of process control and automation. It is by T. J. Williams and has 110 literature references.

The review naturally begins with the epoch-making international congress held last June-July in Moscow at which 284 reports were presented to 1,100 delegates from 29 countries. References are given to several major computer-control installations including the Goodrich Chemical vinyl chloride/acrylonitrile complex. Clearly, the key to the future lies in developing the mathematics.

Control theory is advancing rapidly. Adaptive control, non-linear control, and sampled-data systems have been well covered in the literature; dynamic programming and dynamic optimization of chemical processes are among the newer topics which have begun to be discussed and are likely to become important subjects in the near future. In instrumentation, the most spectacular developments have been in the speed and high-temperature use of gas chromatography. (This is, in fact, illustrated by an advertisement on page 7A of this number of *I/EC*, which explains the advantages of teaming-up gas chromatography with infrared spectroscopy.)

Teachable Managers

Glancing back at the headlines this week, it struck me that they described a handful of the subjects that the modern manager in our industry has to comprehend. Without becoming any less of an art, management is becoming more scientific.

The thought sent me back to Sir Frederick Hooper's book, 'Management Survey', now published as a Pelican at 3s. 6d., which has chapters on 'Scientific Management', 'Management as an Art', and 'What Makes a Man a Manager?'

The foregoing reviews have dealt with quite technical subjects but good management, even in a scientific industry like ours, does not consist in being technical. Good management uses good technicians, sees that their special skills are well directed and well used, that they have a congenial and stimulating atmosphere to work in, and that their rewards in kudos, status, and pay are adequate.

The Scientist Turned Manager

There is a problem — we must have all seen it — of the scientist turned manager. As Sir Frederic says, on page 153 of the Pelican edition: 'It lies in losing a first-class technician and gaining a second-rate manager; one moreover who may be blind to the fact that he is second-rate and that his change of job implies the acquisition of a whole new range of skills and perhaps even a good deal to unlearn. This risk reaches its peak if the person thus promoted proves unable to put his previous technical status behind him, and cannot refrain from interfering with the technicians under his command on the strength of his past expertize, instead of doing his new job of management. The result of such a situation is that the technician turned manager not only does not do his own job, but that he does not allow his subordinates to do theirs'.

Yet it must be in the nature of our group of industries that its management must be mainly recruited from technical staff. We produce and employ materials whose very nature is constantly changing under the influence of scientific discovery purposefully aimed at making such changes, we use processes often based and frequently modified by equipment and plant resulting from the application of new scientific principles or new forms of them. Without a technical background, we cannot understand what we are doing and making.

Yet, basically, it is not scientific knowledge — or any other knowledge, technique, or expertize — which makes a man a good manager; it is something in the grain of a man, qualities of leadership, of ability to explain and persuade, to choose subordinates, to enthuse them and weld them into teams, to evoke loyalty and exact discipline. 'If a man has these', says Hooper, 'or a sufficiency of them, he may be considered to be of managerial calibre. Given reasonable teachability, the rest of his equipment can be added to him afterwards'.

The Teachable Chinese

Bret Harte said that 'the heathen Chinee is peculiar'; I am struck by the fact that he has Hooper's 'reasonable teachability'. As a pendant to my recent review of rubber technology in the Soviet Union, I might draw the attention of all who think seriously about the prospects of the near future, economic, political, technical, to the reprint on pp. 257-9 of *The Listener* for February 9 1961 of a Third Programme talk by Kurt Mendelssohn on 'The Impact of Technology on China'.

'Even five years ago', he says, 'nobody would have thought of China as a great technological power. Today huge industrial plants are rising with enormous rapidity . . . steel production . . . in 1949 which had dwindled to 150,000 tons is now approaching the 18,000,000 mark. In the same time the production of electricity has increased tenfold and that of crude oil 30 times. The story is much the same with most of the other basic products and these are now being joined by machine tools and other factory equipment'. It would be foolish to underestimate the technological potential of China.

Parts Among the Dust and Chickens

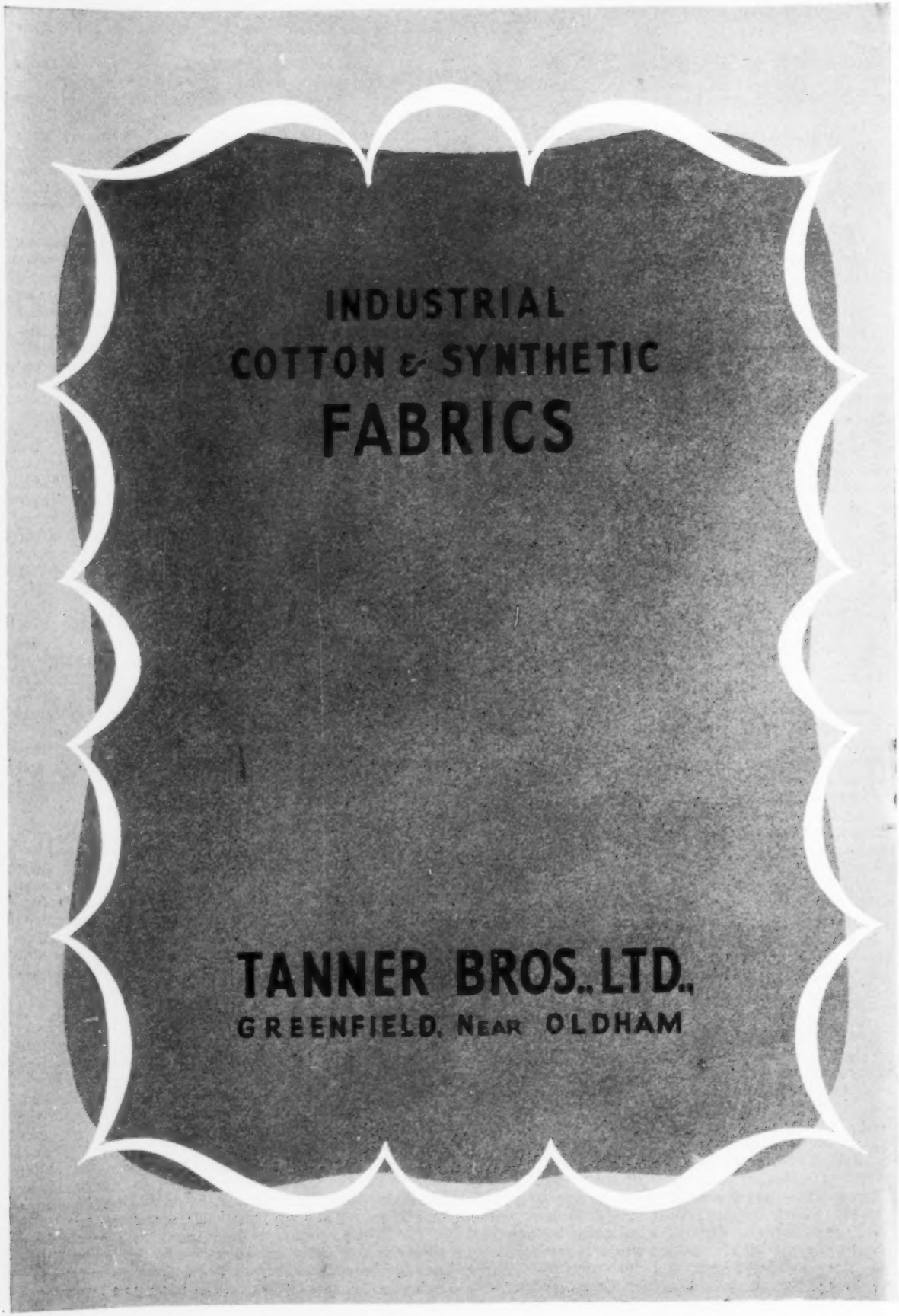
The Chinese are inventive, manually skilful, and responsive to the demands of technology both in their intellectual attitude and in their view of technology as an instrument of liberation and self-respect. Productivity is low at present, backyard industry is common; Mendelssohn himself saw transformer parts being made on a farm, among the dust and chickens, where also 'girls made small plastic component parts in home-made presses'.

The new regime in China is only 11 years old but it is already making a great effort at higher technical education, aiming to get, as quickly as possible, a great number of highly qualified specialists for the technological drive'.

Three years ago the Nobel Prize in physics was awarded to two young Chinese working in America. 'Discussing scientific or technological problems with the Chinese, one becomes acutely aware of many centuries of mental schooling. Their arguments are clever, shrewd, and to the point, and one feels that the minds which for more than a thousand years have been sharpened by classical training find little difficulty in making the change to science'. They are remarkable organizers, too.

The British economy is deriving no small benefit from supplying machinery and know-how to the Soviet Union (notably in rubber and plastics). Is there no such opportunity in China?

CHARLES JENNINGS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MEN and MATTERS

A Review of People and Events

by Peter Richards

AN all-plastic building is being erected by the Eastern Region of British Railways in connexion with the electrification of the Fenchurch Street-Shoeburyness line. Nearly 19ft. long, 14ft. wide and 10ft. high, its bulbous shape gives it the appearance of a giant blancmange or a prefabricated igloo.

Its purpose, however, is serious enough: it is a relay room which will house electrical equipment associated with a nearby signalbox. And one important advantage it has over the traditional brick-built building is that it can be erected within a few hours.

Three Types of Unit

It is composed of three basic types of unit — a corner unit and side units of two different spans. A unit comprises wall and roof in one shell of double curvature designed to take advantage of the mechanical properties of plastic materials:

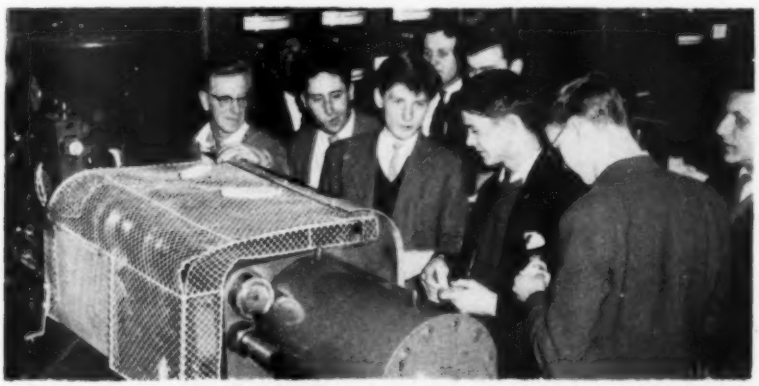
1. An outer laminate of polyester reinforced with glass fibre about $\frac{1}{8}$in. thick with a smooth face from the mould.
2. A core of $\frac{1}{4}$in. thick phenolic foam. This ensures good thermal insulation and fire resistance.
3. An inner laminate of polyester reinforced with glass fibre about $\frac{1}{8}$in. thick, formulated to give a low surface flame spread, and faced with a surfacing mat.

The units are bolted together with stiffening flanges of solid polyester, which also carry the surface runs. The services installed are electric lighting, heating and power, and an automatic carbon dioxide total flood fire fighting system. The floor finish is pvc sheet.

Design and manufacture of the moulds and prototype units has been a lengthy process, but the production of further units by the hand lay-up process will, of course, be more rapid. British Railways intends to make this type of building a feature of its expansion programme.

ES Retires

At the end of this month, Edgar Stott, the export sales manager of Turner Brothers Asbestos Co. Ltd., will retire after 42 years' service with the company. 'ES', as he is known to customers and friends throughout the world, has been a manager within the export organization of Turner's since its inception as a separate department in 1934. The new Export Sales Manager will be J. C. T. Fell (pictured), who, until recently, was the export sales manager of Ferodo Ltd., Chapel-en-le-Frith — a sister company of Turners in the Turner and Newall Organization. Mr Fell takes up his new appointment officially on April 1 1961.



Students from the National College of Rubber Technology studying the injection moulding of nylon at I.C.I. Plastics Division, Welwyn Garden City. The National College paid its annual visit to the Division recently

Another Osma Production

Osma Plastics Ltd. has announced that F. Bull has been appointed a director of the company. Mr Bull has held the post of general manager (Production) since 1957 and is responsible for product development, production and technical service. Prior to joining the company he was for many years with British Resin Products Ltd., first as control physicist and subsequently as a member of the technical service department.

This is the latest of a series of appointments that reflect Osma's rapid expansion in the building field. Last week I reported that R. A. Richardson had been appointed a director.

No More Blankets

'Foambacks' — conventional clothing materials with plastic foam bonded on as a backing — have been in the news recently. One of the firms producing a special grade of expanded polyurethane for this purpose is Kay Brothers Plastics Ltd.

John Webb, a director of the company, said: 'It has to be supple, to have good thermal insulation qualities and to drape well — these are all important. Some polyesters cannot be used, for instance, because they are too brittle and will eventually crack, particularly where they are sewn. The foam must have the same elasticity as the material to which it is bonded'.

Mr Webb and Kay's head chemist, Dr D. F. Rushman, have recently toured Germany and Belgium, and one of the things they investigated was this new use of plastic foam.

After foamback treatment, dress materials can be used for coats and the new technique could mean the virtual disappearance of the heavyweight coat, and the thick woollen blanket.

Plastics Posters

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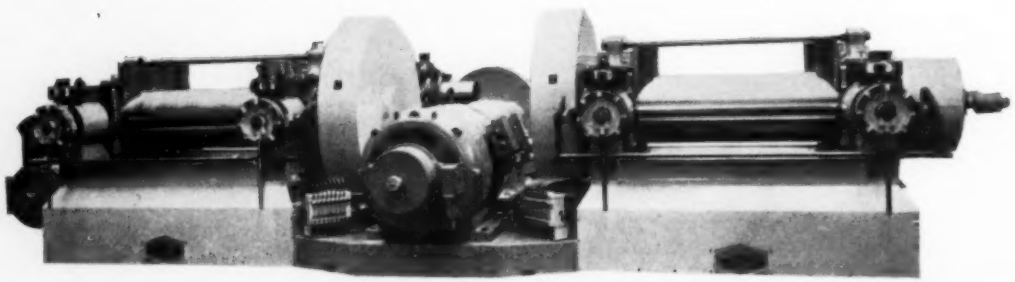

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item goes on posters for advertising meetings. A Midland firm has had a bright idea for producing cheaper — and better — posters for these small concerns, using a vinyl self-adhesive such as Fablon.

The background of the poster is provided by two or three colours or designs, the lettering required sketched on it, and filled in with letters cut from vinyl self-adhesive. The firm supplies boxes of these letters, so that an organization can use a basic poster and announce new meetings by simply peeling off the old letters and sticking on the new. I am told that this ingenious method costs half as much as having the job sign-written, as well as producing a much more durable poster.

A Hit

Quilted pvc, padded with polyurethane foam, is making quite a hit in restaurants and coffee bars throughout London. Paniquil Ltd. tells me that apart from its decorative qualities, it reduces noise to a considerable extent. This firm is producing the quilted material backed with an $\frac{1}{8}$in. thick piece of hardboard.

The material looks as if it will also have a future in the shop window display field.

Joins Monsanto Board

D. C. M. Salt has been appointed a member of the board of Monsanto Chemicals Ltd.

Mr Salt, who joined Monsanto in 1935, has wide experience and knowledge of the company's sales activities. He has been director of sales since 1959, being previously general manager of sales since 1956.

Polly Ester Says . . .

'Cyclic Anhydride — thirsty rider'

THE LEGAL ANGLE

Travel On The Tax Man

By a Barrister

'A small party of British businessmen and industrialists . . . returned from Iraq yesterday'. RPW, February 25 1961.

Every now and again, some lucky businessman goes — or is sent — on a trip to some far corner of the world. But how far will the tax man allow the cost of travel as a legitimate, and allowable, business expense?

If you are 'the holder of an office or employment for profit', whether you are the managing director of a rubber giant or an odd job man in a tiny plastics factory, you will come under Schedule E of the Income Tax Act, 1952. And the only expenses which will be allowable are those 'wholly, exclusively and necessarily' expended in the performance of your duties.

If, on the other hand, you are self-employed: engaged in the rubber or plastics industry on your own account, whether as a manufacturer, traveller, agent or what have you; you will come under Schedule D. And you will be allowed all expenses 'wholly and exclusively' incurred for the business.

Better Off

You will notice that a Schedule D man is a great deal better off than one who comes under Schedule E, because the question of whether or not the business expense was 'necessarily' incurred, does not arise. If, then, you are a company director and decide to go off to Timbuctoo to investigate rumours of an ultra-modern plant, producing synthetic rubber by a new method, the tax man may or may not allow this expense. The fact that you were going for the business is only part of the question. The rest is, 'was it necessary for you to go?' But if you are not an employee and decide to make the trip for your business, that is the end of it — your expenses will almost certainly be allowed.

In this country, business travel is in its infancy. In the USA, we found it a booming business on its own. Groups of Northern manufacturers, retailers and the like were travelling to Florida in the bleak, winter months, inspecting plants, factories and shops, opening up new markets, making contacts and holding conventions. And Southerners were escaping to the North during the sun-scorched summer, on similar errands. The fact that they may have enjoyed the experience, spent weekends playing poker or lazing by the lake, was neither here nor there, and certainly none of the business of the tax man.

If, then, you feel like mixing business with pleasure — or rather, going on pleasurable business, out of town and possibly abroad — why not have a word with your tax man? It is quite possible that you could enjoy yourself enormously and, perfectly legitimately, save yourself money at the same time.

Travelling Expenses

Incidentally, have you ever tried getting an allowance for the cost of travelling from your home to your factory, office or workshop? If not, do not bother. It has been decided that the expenses of getting to the place where you must perform your duties are not allowable. Why? Because these expenses are incurred in order that you may start performing your duties and not 'wholly and exclusively in connexion therewith'.

On the other hand, expenses which you actually incur in the course of your employment or business, in order to get from place to place, will be allowable. The representative who sells your lines in various parts of the country will be allowed most of the cost of his car. True, a proportion will be deducted, if he uses the vehicle to get from home to the factory or to his first call, or for other private purposes, but the bulk will be deductable. And the same applies to your car. If it is in your name, the chances are that the tax man will allow you a fair proportion of its running expenses, if you use it for your business. And if it is the company's car and you are allowed to use it, a proportion of the running costs will be attributed to your private use, regarded as a benefit in kind, and you will be taxed on it.

The moral? Much money would be saved if businessmen knew just how far they could travel on the tax man. So, if you are in doubt, the sooner you consult your accountant or your lawyer, the better for your bank balance.

Rubber Statistics

WEST GERMANY — MALAYA — UNITED STATES

THE West German rubber industry is pessimistic about its further export chances following the revaluation of the mark, a spokesman for the industry said recently.

Although the price of rubber had fallen of late and the tendency appeared to be further downwards, manufacturers in other countries had the same advantage, and international competition was sure to become keener, the spokesman added.

West German rubber tyre production fell slightly to 18,682 tons during January from 19,300 tons in December and 16,564 tons in January of last year, according to figures issued by the Federal Bureau of Statistics.

In the individual sections of the West German rubber tyre industry production was (in 1,000 units, January figures provisional):

	Jan.	Dec.	Jan. 1960
Bicycle tyres ..	1,117	1,016	1,095
Motor-cycle tyres ..	65	68	70
Car tyres	1,054	1,209	884
Lorry tyres ..	142	159	140

Output of other hard and soft rubber goods during January amounted to 26,221 tons against 24,654 tons during December and 21,683 tons in January of last year.

Imports figures for natural rubber and rubber sole crepe or of synthetic rubber for December and during 1960 are not yet available.

Malaya

Imports of rubber into Malaya and Singapore during February amounted to 24,303 tons as shown by final documents received, according to preliminary figures released by the Chief Statistician.

This figure included 11,544 tons imported on provisional permits in previous months for which final documents have been received and excluded approximately 14,073 tons imported during the month for which final documents have not yet been received.

The comparative figures for January were 31,668, 14,153, and 13,823 tons respectively.

United States

The United States Rubber Manufacturers' Association reports that total consumption of new rubber in January amounted to 122,351 tons against 111,967 (revised) in December.

Consumption in January comprised 35,225 tons of natural rubber and 87,126 tons of synthetic rubber (including 72,220 tons SBR). December consumption (revised) comprised 31,891 tons of natural rubber and 80,076 tons of synthetic (including 67,549 tons of SBR).

Total synthetic rubber production in January was 105,877 tons against 104,659 tons (revised) in December, while production of SBR was 84,677 tons against 86,242 (revised) in December.

Total synthetic rubber exports in January were 26,770 tons against 23,231 tons (revised) in December.

Cork/Nitrile Tile

A flooring tile made from a cork/Hycar nitrile rubber combination is being produced by British Technical Cork Ltd., of Reading. It is said that the tile will withstand the exceptional pressures exerted by stiletto heels, and is also oil-resistant and has excellent non-slip properties.

For the domestic market, the tiles are being made in standard 5yd. packs and in seven colours, and an industrial tile is also being manufactured.

Plantation Commentary*

THE LAST CHANCE TO REDUCE COSTS

by our Malayan Correspondent

FROM KUALA LUMPUR

A WARNING that the next few years will be the last chance for rubber growers to achieve a reduction in costs before the impact of the stereo-regular rubbers is fully felt, is contained in the 1960 annual report of the Rubber Producers' Council published last week. The council is the representative body in Malaya of the rubber industry and is made up of members from the Rubber Growers' Association, the Malayan Estate Owners' Association, the United Planting Association of Malaya and the Council of the Malayan Smallholders' Association.

The report stresses the need for continued replanting with high-yielding rubber, which is necessary for the long-term benefit of Malaya as a whole because the country is so largely dependent on the rubber producing industry. 'The industry must be in a position to compete with synthetic on a price basis and producers must replant to achieve this and to survive', says the report.

Replanting Scheme Urged

It urges that a scheme for estate replanting should be prepared which will become effective from the beginning of 1963 when present Government help to estates to replant will begin to tail off. But the report was written before the publication in recent weeks of the Second Five-Year Development Plan, which contains provision for continuing replanting aid to estates and smallholdings, though the details have not been announced yet.

The council's report points out that since 1951 a total of 721,000 acres of estate rubber and 480,000 of smallholding rubber out of a total acreage of 3,500,000 acres has been replanted and declares that 'it is abundantly clear that the objective of increasing the area of rubber land planted with high-yielding material is being successfully achieved'. But much remains to be done, it says, and at the end of 1960 about 52% of the total acreage under rubber still remained under old unselected seedlings, or 40% of the estate acreage and 67% of the smallholdings.

For estates, the present Government scheme provides £46 15s. an acre towards the costs of replanting and new planting, up to 21% of the replanted acreage of estates, and up to £70 an acre for smalholdings.

A strong plea is made in the report to the Government to defer a decision to ban the use of sodium arsenite as a weed killer by the industry from September 1 this year. The Government's decision to ban the use of this weed killer followed complaints from villagers that their cattle were dying after eating grass poisoned with sodium arsenite, though notices are posted when the weed killer is sprayed. The report estimates that the ban will increase the cost to the 'rubber producing and related industries' of weed control by $8m. (about £1m.) a year through having to use other materials. Against this is the figure of $146,000 quoted as the value of cattle killed during 1959 from eating poisoned grass.

The report points out that there is at present no substance marketed in Malaya comparable with sodium arsenite as a general weed killer. Sodium chlorate is not so effective and must be used in larger quantities and the use of 2.4.5-T for tree poisoning is 'considerably more costly'. The report hopes that the ban will be deferred until a cheap and effective alternative is available on the Malayan market.

**To assist readers to keep up-to-date with the changing Malayan rubber scene, from this issue Plantation Commentary will be a weekly feature.*

Rubber and Plastics Stock Market

A REVIEW OF PRICES AND TRENDS

SUDDENLY it is spring. Along Throgmorton Street these days you might not see many 'daffs' or tulips. To make up for this, however, there has been plenty of hustle and bustle and the plus signs have blossomed nearly everywhere. The whole stock market seems to have taken on the kind of look of expectancy you would expect about this time of the year. Much of the indecision that has been experienced during the winter months has disappeared as the buyers have cast off their doubts and taken a bold view about the future. Suddenly it is certainly spring and the hopes of better things to come seem to be infectious. From reports it is evident that many leaders in industry are becoming more optimistic and the feeling now is that a 3% rise in gross national product over the year is now definitely on the cards. Nearer to our own doorstep is the growing evidence of a big recovery in the motor industry. Two of our leading manufacturers have reintroduced overtime working in their car department. Things are improving so fast in this part of our economy that there are many who think that the car firms will *all* be back to 100% production by the summer as against 75% of capacity as at present. So watch out for plastic shares over the next six months or so. Heavy electricals such as AEI, GEC and English, too. My tip at present is TURNER AND NEWALL which, if a summer boom does occur, could hit the high spots all over again.

From the boardrooms of the giant ASSOCIATED ELECTRICAL INDUSTRIES word was sent that the net trading profit had fallen just a fraction from £4,746,900 to £4,722,400. But Lord Chandos, that very able chairman, kept the dividend at 3s. per £1 unit. Among the vast amount of information provided for shareholders were these important factors: orders up from £182m. to a topping £223m.; orders in hand at the end of the year amounted to £181m. compared with £173m. at the end of 1959. Turnover during the period under review hit the £215m. mark with a jump of £7m. This showing was in line with most expectations and the shares as a result have since improved.

Best ever profits were announced by BAKELITE and for shareholders the dividend has been hoisted from the equivalent of just over 14½% to 17½%. After depreciation the group made £1,350,800 against last times total of

Continued on page 439

Share Price Movements

Par Value	Company	1960-61 High	Low	Mar. 4	Latest
£1	A.E. Ind. Ord.	67/-	39/-	42/3	48/6
5/-	Albright & W. Ord.	34/3	25/-	27/-	28/6
£1	" " " 5% Pref.	17/3	14/3	15/6	14/3
5/-	Anchor Chemical Ord.	23/6	14/9	22/-	22/-
4/-	Airfix	49/6	23/-	45/-	48/-
4/-	" Non Voting	45/3	23/-	43/6	44/6
5/-	Andersons Rub. Ord.	—	—	3/9	3/9
£1	Angus Geo. Ord.	69/6	34/9	69/3	68/9
5/-	Ault & Wiborg Ord.	28/-	20/-	25/6	26/3
£1	Avon India Rubber Ord.	46/6	30/-	40/-	38/6
£1	" " " 6% Pref.	20/-	17/6	18/9	18/9
10/-	Bakelite Ord.	56/3	33/3	50/6	52/6
£1	" 6% Pref.	19/3	16/9	18/-	18/-
£1	Baker Perkins Ord.	50/3	39/1½	48/3XR	49/6
4/-	Bank Bdg. Rubber Ord.	4/3	1/9	2/6	3/3
4/-	Bettix	—	—	9/-	10/-
4/-	Brammer H. Ord.	18/6	16/3	16/6	17/-
10/-	Bridge, David Ord.	66/6	48/-	63/3	64/9
5/-	Bright, John Ord.	18/6	14/3	15/9	15/9
5/-	Brit. Blting & Asb. Ord.	19/9	17/-	19/6	19/9
£1	" " " " Pref.	—	—	15/9	15/9
5/-	British Electronic Indus.	15/-	12/-	13/6	13/9
2/-	Brit. Ind. Plas. Ord.	13/9	5/3	12/9	13/6
2/-	" 10% (tax free) Pref.	4/9	4/3	4/9	4/9
£1	British Xylonite Ord.	92/6	50/6	82/-	91/3
£1	" " 5% Pref.	18/9	14/-	15/-	15/-
£1	BICC Ord.	61/3	47/6	56/-	57/3
5/-	BTR Ind. Ord.	17/9	9/9	16/3	16/6
£1	" " 7½% Pref.	24/3	21/3	21/6	21/3
£1	Courtaulds Ord.	59/4½	42/-	43/6	42/9
£1	" 5% 1st Pref.	17/9	15/-	15/3	15/3
£1	" 6% 2nd Pref.	21/-	17/6	17/6	17/6
4/-	Cow, P. B. Ord.	9/9	6/9	8/4½	8/9
£1	" " 5% Pref.	15/6	13/6	13/6	13/6
1/-	Dannimac Mfg. Ord.	14/6	9/-	12/3	12/9
10/-	De La Rue Ord.	78/6	47/9	61/9	62/6
£1	" " " 3½% Pref.	12/-	10/-	10/6	10/-
10/-	Distillers Co. Ord.	38/3	27/9	33/9	37/-
£1	" " 6% Pref.	22/-	19/6	20/-	20/-
£100	" 5% Conv. Loan	£96	£93½	£95	£95
£100	" 5½% Unsec. Loan	£97	£81	£83	£81
10/-	Dunlop Rubber Ord.	30/6	19/9	23/6	23/9
£1	" " 5½% Pref.	19/-	15/3	15/9	15/6
£100	" 3½% 1st Debs.	£78	£68	£68	£68
£100	" 4½% 2nd Debs.	£87	£77½	£79½	£78
£1	Eng. Elect. Ord.	53/6	30/9	33/9	40/6
4/-	Ebonite Cont. Ord.	14/3	7/9	8/-	8/-
£1	English China Clays Ord.	96/9	69/-	91/9	96/-
£1	Goodyear Tyre 4% Pref.	12/9	10/6	11/-	11/-
5/-	Greeff Chem. Ord.	35/-	23/-	29/9	28/3
10/-	Greeff Chem. 5½% Pref.	9/-	7/9	7/9	7/9
4/-	Greengate & Irwell Ord.	6/6	5/3	5/9	6/-
5/-	Hackbridge Hldg.	8/7½	5/-	5/9	6/9
£1	Harrisons & Crosfield Dd.	64/-	48/6	53/-	52/9
1/-	Hunt & Moscrop Ord.	2/9	1/4½	2/-	2/3
£1	Imp. Chem. Ord.	75/3	54/3	70/1½	71/-
£1	" " 5% Pref.	18/-	15/6	15/9	15/6
£100	" 4½% Unsec. Loan	£89½	£78	£80	£79
£100	" 5½% Conv. Loan	£212½	£90xc	£92½	£90
1/-	Kleemann (O. & M.) Ord.	17/6	8/3	13/1½	17/4½
£1	" 6½% Pref.	19/-	16/6	16/9	16/3
5/-	Laporte Ind. Ord.	33/6	21/3	26/6	29/9
£1	" " 7½% Pref.	24/3	22/-	22/-	22/-
£1	Leyland & Birm. Rubber Ord.	63/-	46/3	47/3	49/-
£1	" " " 6% Pref.	19/-	17/6	18/1½	18/1½
2/-	London Rubber	16/6	11/-	16/3	17/-
£1	" 6% Red. Cum. Pref.	20/-	18/-	18/6	17/6
£1	McKechnie Bros. Ord.	71/6	53/6	54/6	54/6
£1	" " 'A' Ord.	69/3	52/6	53/3	53/-
£1	" " 6% Cum. Pref.	18/-	16/-	17/-	17/-
5/-	Monsanto Chem. Ord.	31/-	23/-	23/6	24/3
£1	" " 3¾% Pref.	12/9	11/9	12/-	11/9
£100	" " 6% Debs.	£103½	£96	£97	£97
5/-	Miles (H.G.) Hldgs. Ord.	11/3	7/6	7/6	7/6
2/-	Movitex	—	—	7/-	6/9
£1	North British Rubber	21/3	15/-	16/-	15/-
5/-	Northwestern Rubber	13/-	9/-	12/-	12/-
5/-	Plastic Enginrs. Ord.	36/-	20/-	35/-	35/9
10/-	Projectile & Eng. Ord.	37/6	18/6	35/6	36/-
5/-	Redfern Holdings Ord.	5/9	3/1½	3/6	4/-
2/-	RFD Ltd. Ord.	6/6	3/4½	4/-	4/6
£1	" " 5½% Pref.	14/6	12/9	13/9	13/9
2/-	Rubber Imp. Ord.	7/9	3/1½	5/-	5/3
2/-	" " 'A' Ord.	7/-	3/-	5/-	3/9
£1	" " 5% 1st Pref.	15/-	11/3	12/3	12/3
5/-	Rubber Reg. Ord.	19/3	16/9	17/-	17/3
4/-	Shaw Francis Ord.	27/6	17/3	22/9	22/6
2/-	Silentbloc Ord.	13/3	8/6	8/9	9/3
5/-	Storey Bros.	46/-	28/3	42/3	45/3
2/-	Sussex Rubber Ord.	2/3	1/3	1/9	1/9
5/-	Sutcliffe Speak Ord.	15/9	11/-	14/-	14/1½
£1	Tootals	33/6	26/4½	31/9	31/6
£1	Turner & Newall Ord.	69/-	48/3	63/9	68/9
£1	" " " 7% Pref.	25/-	21/3	21/3	21/3
5/-	Universal Asbestos Ord.	50/-	24/-	25/3	26/3
5/-	Viscose Dev. Ord.	16/6	14/9	15/-	16/-
5/-	Warne W. (Holdgs.) Ord.	18/9	14/9	15/6	16/9

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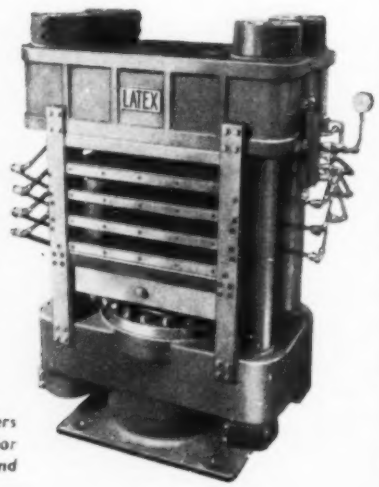

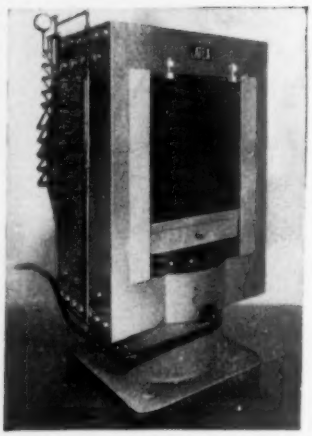

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Rubber Markets

LONDON

After some irregularity with wide fluctuations in an uncertain market, the advance was resumed, sometimes led by Singapore and at other times by London. The main interest was in near Terminal positions which hardened sharply on nervous short covering orders, which found sellers reluctant. Factory demand remained small.

Latest prices are as follows:

No. 1. RSS Spot: 26¼d.-26½d.

Settlement House:
April 26½d.-26¾d.
May 26⅝d.-26⅞d.
June 26d.-26¼d.
April/June 26⅜d.-26⅝d.
July/September 25⅞d.-26⅛d.
October/December 25⅝d.-26⅛d.
January/March 25⅜d.-26d.

No. 1 RSS cif basis ports:
April 25½d.-25¾d.
May 25¼d.-25¾d.

Godown:
April 86⅜ Straits cents, nominal.

LATEX

Centrifuged 60% latex per gallon in drums, seller, March, April, 14s. 9d., cif European ports. Spot, seller, 15s. 3d. Bulk, seller, d.w. 14s. 8d. Creamed, seller, 14s. 6d. nominal. Normal, seller, March, April, 12s. 1d.

NEW YORK

The New York rubber market ruled as under on March 13:

DEALERS' PRICES

	US cents per lb., ex-dock	
	Mar. 13	Previous
No. 1 RSS, March ..	30¼a	30a
April ..	30a	29⅞a
No. 2 RSS, March ..	30⅛a	29⅞a
April ..	29⅞a	29⅝a
No. 3 RSS, March ..	30⅛a	29⅞a
April ..	29⅞a	29⅝a
No. 1 RSS, Spot ..	30⅛n	30¼n
No. 3 amber blanket crepe, March ..	24⅞n	24⅛n

FUTURES — REX CONTRACT

	March 13	Prev. Close
March ..	30.00b–31.00a	29.60b–30.00a
May ..	30.00b–30.25a	29.45b–29.60a
July ..	29.85t	29.20b–29.30a
Sept. ..	29.65b–29.70a	29.05b–29.15a
Nov. ..	29.65t	29.05b–29.15a
Jan. ..	29.60b–29.70a	29.05b–29.15a

Sales: 37. Tendency: Firm.

Futures were firmer on March 13 on scattered covering, following the advance in foreign markets. Traders said that physical rubber was firm but so far quiet. Trade sources expected other leading rubber manufacturers to follow the price advances in passenger car and truck tyres announced by the US Rubber Company. In the closing stage, futures remained firm, up more than ½ cent per lb. Dealings were modest for the day.

SINGAPORE

The market was inactive during the morning of March 13 and business was confined to sheet No. 1 RSS and some switching of lower sheet. May sheet No. 1 RSS was thinly traded at ½ premium to April. In the afternoon, the market had a slow opening. Prices ruled steady when small buying was unsatisfied at the 86 cents level. Lower sheets were neglected.

	Malayan cents per lb., fob Malayan ports to open ports	
	Mar. 13	Prev. Close
No. 1 RSS, April ..	85⅞–86	85⅛–85⅜
May ..	85⅞–86⅛	—
No. 2 RSS, April ..	84⅛–85⅛	—
No. 3 RSS, April ..	83⅛–84⅛	—
No. 4 RSS, April ..	80⅞–81⅛	—
No. 5 RSS, April ..	71½–72½	—
No. 1 RSS, Spot ..	85⅛–85⅝	84⅛–84⅜
No. 3 blanket thick re-milled crepe, April	66½–67½	—
No. 1 fine pale crepe, April	90½–91½	—
2X thin brown crepe, April	65½–66	—
Tendency:	Steady.	

The Industries Syndicate quote latex, native produce, 60% centrifugal, packed in rectangular drums, fob at 165.20d. per gallon.

AMSTERDAM

The Amsterdam rubber market ruled as under on March 13:

	Guilders per kilo	
No. 1 RMA	Mar. 13	Previous
March	2.40	2.37
April	2.40	2.37
May	2.40	2.37
June	2.40	2.37
April/June	2.40	2.37
July	2.39	2.36

Sales: Nil. Tendency: Quiet.

DJAKARTA

Prices were unchanged from Saturday's levels. There were many buyers on March 13 and 15 tons of sheet No. 1 were sold at 31 rupiahs while a small quantity of sheet No. 2 was sold at 30 rupiahs per kilo. The marked closed steadier.

	Rupiahs per kilo	
	Mar. 13	Previous
Spot No. 1 priok ..	30.75b	30.75b
Spot No. 2 priok ..	29.75b	29.75b
Spot No. 3 priok ..	28.50b	28.50b
No. 1 fine pale crepe, spot	28.50b	28.50b

CEYLON

The price of No. 1 RSS at Colombo on March 13 was 106 Ceylon cents per lb.

BANGKOK

The price of No. 1 RSS at Bangkok on March 13 was 27.00 (27.00) US cents per lb.

STOCK MARKET

Continued from page 437

£1,250,500. During the past fortnight its shares have climbed to a new 'high' of 56s. 3d. Since then they have reacted to 52s. 6d. but still show a net gain of 2s. 6d. over that time.

I wonder if Sir Miles Thomas has had cause to think again since his recent annual report about prospects for his MONSANTO CHEMICALS? In generally guarded terms he said that a number of sections of industry here at home seemed to be going through a period of selective adjustment to demands from both domestic and overseas sources. This could be expected in due course to bring about alterations in the company's trading patterns. The groups' products did well in the first half of 1960 but the slowing down of industrial activity, however, affected the second half of the year. The new polystyrene plant which began work at the end of the year to produce special grades, should increase flexibility of operations and strengthen the company's competitive position in the plastic industry.

Still on the boardroom front came news that F. W. BERK had exceeded its dividend forecast with proposed payment of 8¼d. per share on a larger capital this time. Before the tax man had taken his share, profits were around £679,000 compared with £522,500.

Breath of optimism in the statement from ANCHOR CHEMICALS. Sales are continuing at a satisfactory level and subject to economic stability the company sees no reason why progress should not continue during the current year. In the past trading year the firm increased sales of its own products by 22% and exports were also up by the same amount — the eighth consecutive year of higher exports.

'Carlona P' polypropylene, manufactured by Shell Chemical Co. Ltd., is being used by Kent Mouldings Ltd. to mould this television deflector coil for television tubes for the Plessey Co. Ltd. This new application illustrates the electrical resistance, lightness and strength of polypropylene

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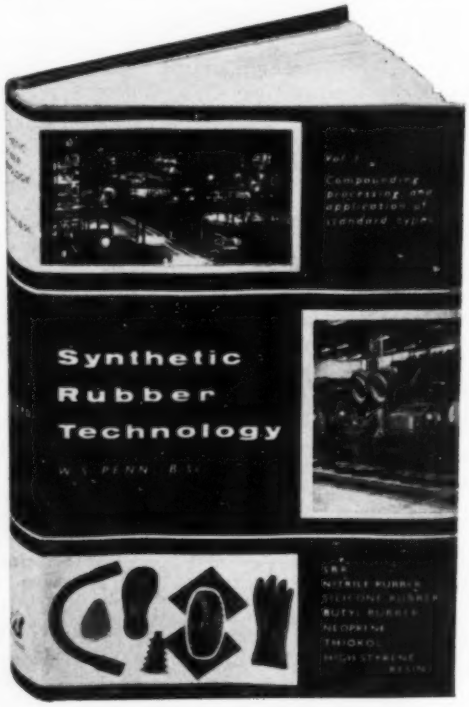

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Industry INTELLIGENCE

Technical Data

Durez Wax Emulsions

A data sheet recently issued by Omni (London) Ltd., 35 Dover Street, London, W.1, gives formulations for industrial floor polishes containing Durez wax emulsions. These are based on Primal acrylic emulsions manufactured by Rohm and Haas and distributed in the UK by Charles Lennig and Co. (GB) Ltd.

Data sheets, samples and prices of the Durez resins recommended in these formulations, which are Durez 19788 and Durez 17211, are available from Omni Ltd. at the above address.

PVA Emulsion Paints

Technical Note No. 11, first published by British Titan Products Co. Ltd., 10 Stratton Street, London, W.1, in 1953, and BTP/41 published in 1956, expressed the early views of the company on pva emulsion paints. These two publications have been thoroughly revised, and fresh data introduced in a recently issued booklet.

This booklet gives information about formulation, manufacture, stability, application properties and exterior durability of pva emulsion paints to the extent that these features are affected by pigmentation with titanium dioxide.

Attention is drawn to a number of points which have been shown to be of vital importance when dealing with these paints, but many of the principles set out can be extended to paints based on other types of emulsion.

The sections into which the booklet is divided can all be read separately, though all are complementary, and each section carries a short summary. The sections are: general technology, formulation, manufacture, application properties, can stability, exterior durability, tint retention on exposure and recommended pigmentations.

Machines, Materials and Equipment

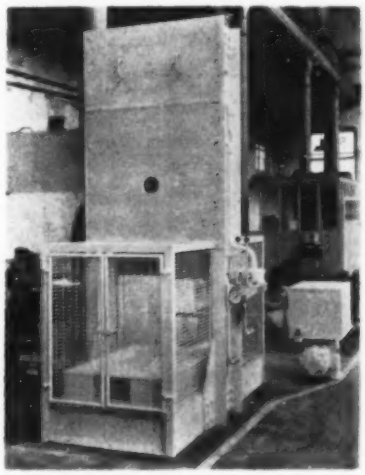
Rubber Bale Splitter

Sutcliffe Hydraulics Ltd., of Castleford, has introduced a new rubber bale splitter.

This machine, which has been designed to split up bales of raw rubber, is really a down-stroking press with a table on which the bale is placed and a blade in place of the usual top die.

It consists of a baseplate on each side of which, and at about its centre, large rolled steel channels are bolted to form two columns, the latter being tied together at their tops by a strong bridge constructed of rolled steel joists welded together.

On the underside of the top bridge several double acting hydraulic rams are positioned and a blade made of 1in. mild steel plate is fitted to the lower end of the rams. The blade is held in guides which are fitted to the columns, and it is also fitted with a renewable cutting edge.



In order to move the bale under the blade, a traversing table is fitted on the baseplate. The table is traversed by a hydraulic cylinder. The columns and blade cylinders are all encased in sheet metal guards, and mesh guards are provided over the traversing table so the actual splitting operation may be witnessed in safety.

The hydraulic cylinders which raise or lower the blade are all banked together and fed from one control valve; the latter is banked together with the valve which is used to control the traversing table.

Common supply and return mains are taken from the control valves to a power pack, the latter consisting of a fixed delivery pump coupled to an electric motor, both of which are flange mounted to a stool which acts as a baseplate, coupling guard, and support for the oil tank. A filter is fitted in the tank and an adjustable relief valve is supplied so the pressure may be varied if found necessary.

The standard machine has a capacity of splitting bales 1ft. 9in. high x 2ft. 3in. wide x 3ft. long with a single blade, but other size machines are available as also is a two-bladed machine to meet special requirements.

Batchcounting

Electronic Machine Co. Ltd., who are the makers of the Batchcounter range, has now re-designed its units to provide a more flexible form of basic off-the-shelf type of instrument.

By the inclusion of the necessary stampings and fixing lugs together with comprehensive printed circuitry it is now claimed that it is possible to take a nearly completed unit off the shelf and in a few minutes add the necessary components to meet the requirements of the stated application. The front panel has airtight and dust-tight enclosures, and the batch number selector switches, click positively into their new position when rotated and simultaneously a circular disc, fixed to the switch knob spindle behind the panel, shows the selected batch number through an observation hole in the panel. Also included is an internal mains adjustment panel and a toggle type reset switch. Made for rack, panel or case mounting, the machine can count up to 20,000 objects per minute.

Publications

Plastics in Packaging

Over the past few years the usage of plastics in the expanding packaging field has increased considerably.

This expansion is illustrated in a booklet recently issued by Distillers Plastics Group, Devonshire House, W.1, called Plastics in Packaging.

With the aid of many illustrations, the booklet expounds the uses of plastics for wrapping up confectionery, vegetables, stationery, chemicals and several other products. Among the plastics mentioned are Rigidex polythene and Styron polystyrene which are especially suitable for packaging preserves, mincemeats, meat extracts, sauces, pickles, and similar foodstuffs. Styron polystyrene is also claimed to be admirably suited to the mass production of confectionery dispenser stands, because of its strength, firmness, and imperviousness to moisture.

Terylene Booklet

A booklet called 'Terylene Sewing Threads for the Shoe and Leather Trades' has recently been issued by Imperial Chemical Industries Ltd., Fibres Division, Hookstone Road, Harrogate, Yorkshire.

The publication, which is illustrated throughout with photographs and diagrams, begins with an article on the advantages of Terylene which include its strength, resistance to the rotting action of mildew and bacteria, flexing and abrasion. This is followed by details of the use of Terylene thread in footwear, and an article giving the solution to mending broken-down heels and worn soles. The booklet concludes with some case histories of manufacturers who have changed to Terylene, and their reasons for doing so are also given.

CROP RETURNS

Unless otherwise indicated, the figures quoted, to the nearest thousand lb., represent crop returns for the month stated and for the number of months of the planting company's financial year to date. Corresponding figures are given in parentheses.

HARRISONS AND CROSFIELD LTD.
January

London Asiatic.—1,866 (1,763). 1 mth—1,866 (1,763).
Oriental.—339 (275). 1 mth—339 (275).
Lanadron.—548 (459). 1 mth—548 (459).
Pataling.—1,518 (1,467). 3 mths—4,411 (4,339).
Jugra.—520 (548). 3 mths—1,490 (1,603).
Golden Hope.—836 (795). 11 mths—8,063 (8,199).
New Crocodile.—270 (257). 11 mths—2,686 (2,606).
Bukit Kajang.—152. 152.
Castlefield.—305 (274). 7 mths—2,004 (1,927).
Holyrood.—103 (102). 1 mth—103 (102).
Hongkong.—44 (33). 1 mth—44 (33).
Hoscote.—303 (253). 7 mths—1,967 (1,690).
Killinghall.—65 (50). 7 mths—380 (313).
Kuala Selangor.—78 (71). 1 mth—78 (71).
Kulai.—210 (186). 3 mths—607 (532).
Malaysia.—75 (68). 1 mth—75 (68).
Prang Besar.—371 (328). 10 mths—3,471 (2,609).
Sandac.—62 (69). 10 mths—677 (782).
Seaport.—112 (84). 7 mths—652 (513).
Malayalam.—896 (699). 10 mths—8,224 (6,778).
Lunuva.—96 (121). 1 mth—96 (121).
London Sumatra Group.—2,963 (2,491). 10 mths—26,610 (23,719).
Bah Lias.—221 (154). 3 mths—661 (483).
Central.—90 (77). 7 mths—556 (502).
North Tongan.—321 (240). 5 mths—1,388 (1,208).
Sialang.—262 (238). 12 mths—2,756 (2,441).
Tanah Datar.—77 (67). 1 mth—77 (67).
Bajoe Kidoel.—247 (242). 10 mths—2,233 (2,025).
Djasinga.—99 (96). 7 mths—684 (717).

Latest Wills

Donald Farquharson, of Green Lawns, Broad Highway, Cobham, Surrey, former rubber planter in Malaya, who died on October 27 last, aged 69 years, left £91,382 gross, £87,130 net value.

Future Events

Institution of the Rubber Industry

Merseyside Section.—March 25 at Reeces', Parker Street, Liverpool. Dinner-dance.

Plastics Institute

London and District Section.—March 21 at the Wellcome Building, Euston Road, N.W.1, at 6.30 p.m. Students' meeting — 'Your Questions Answered'.

Scottish Section.—March 23 at the Kenilworth Hotel, Glasgow, at 7.30 p.m. 'Pre-impregnated Materials', by S. C. Maskell, API (Aeroplastics Ltd.).

Western Section. — March 22 at Stroud Technical College, at 7 p.m. 'The Use of Plastics in the Post Office Engineering Department', by R. L. Bull, BSc, FRIC.

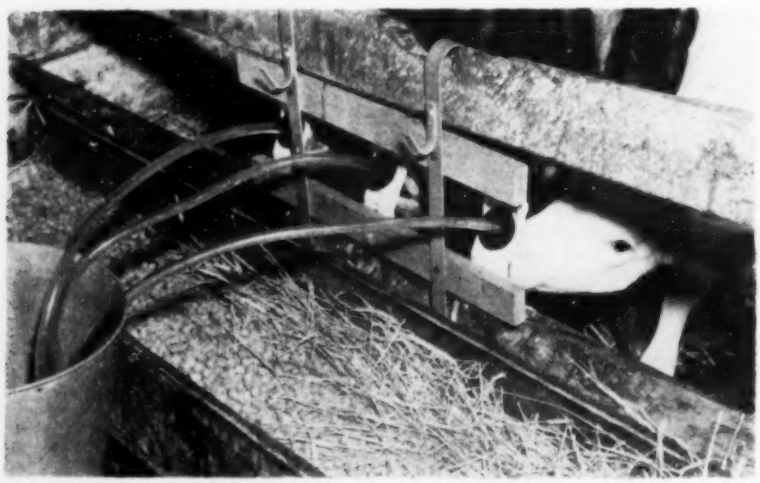
NEW COMPANIES

Brendan Processes Ltd. (683,184).—February 13. Capital: £250 in £1 shares. To carry on the business of importers, exporters, manufacturers of and dealers in plastics, etc. The subscribers (each with one share) are: A. Heald, solicitor, and E. R. Holt, solicitors clerk, both 5 New Court, Lincoln's Inn, W.C.2. The first directors are not named.

Rowley (Plastics) Ltd. (683,233).—February 13. Capital: £2,000 in £1 shares. The directors are: Ronald Rowley and Mrs. Doris Rowley, both of 36 Stapleford Road, Kings Heath, Birmingham, 14. Regd. office: 1267 Pershore Road, Birmingham, 14.

Maybank Plastics Ltd. (683,213).—February 13. Capital: £5,000 in £1 shares. To carry on the business of processors, importers and exporters of and dealers in plastic goods of all kinds, etc. The subscribers (each with one share) are: Edward J. Vickers and Ian E. Fisk (solicitors), both of 21 Devonshire Street, W.1.

C.B.M. Productions (London) Ltd. (683,305).—February 13. Capital: £2,000 in £1 shares. To carry on the business of manufacturers of and dealers in plastic, modelling and moulding materials, etc. The directors are: Clifford Calladine, 1 Rochester Road, Tonbridge, Kent; Peter J. Bradley, 67 Estridge Way, Tonbridge, Kent. Regd. office: 87 Bishopsgate, E.C.2.



This 'Calfeteria' feeding device for calves makes use of teat brackets moulded by Henley Plastics Ltd. in British Resin Product's high-density polythene. The calves feed through teats attached by flexible pipe to a bucket of milk, the teat being held in place by the Rigidex brackets. The complete device is made by Dalton Supplies Ltd.

TRADE MARKS

Objections to the registration of any of the undermentioned applications may be lodged with the Comptroller-General of Patents, Designs and Trade Marks at the Patent Office, 25 Southampton Buildings, Chancery Lane, London, W.C.2, within one month of the date mentioned. The objections must be stated on Trade Marks Form No. 7, cost £2, obtainable through any money order office. The extracts—from 'The Trade Marks Journal'—given below are reproduced by permission of the Controller of H.M. Stationery Office.

VINACRYL (807,823) Emulsions, solutions and dry polymers, all being synthetic resins for use in manufacture, and containing acrylic polymers and co-polymers. Vinyl Products Ltd., Butter Hill, Carshalton, Surrey. (Class 1; February 22 1961.)

DELCRETE (812,035) Plasticizers being chemical substances for addition to concrete for affecting the setting properties thereof. George Lillington and Co. Ltd., Willow Lane, Mitcham, Surrey. (Class 1; February 22 1961.)

DECORDECK

(B803,387) Sheets, rods, strips and shaped sections, all made of common metal; sheets, rods, strips and shaped sections, all made of common metal coated with plastics, the metal predominating; and articles made from these goods and included in Class 6. The Ruberoid Co. Ltd., Commonwealth House, 1/19 New Oxford Street, London, W.C.1. To be associated with No. B803,386 (4304, 263). (Class 6; February 22 1961.)

TELEFLEX (791,533) Parts made of plastics, of machines and motors, all included in Class 7. Teleflex Products Ltd., 9 Cavendish Square, London, W.1. To be associated with No. 558,781 (2980, 570) and others. (Class 7; February 22 1961.)

METALASTIK CONTRASONIC

(782,354) Parts included in Class 12 of land, air and water vehicles, all being goods made of rubber and metal or of artificial rubber and metal. Metalastik Ltd., Evington Valley Road, Leicester. To be associated with No. 725,996 (4042, 1122) and others. (Class 12; February 22 1961.)

MOVITEX (812,873) Sheets, shaped sections, beadings, bands, strips, films, plates, slabs, blocks, bars, rods, tubes and cylinders, all made of plastics, gutta percha, india rubber or of synthetic rubber; and articles made from any of the aforesaid goods; all included in Class 17. Plastic Fasteners Ltd., 2/3 Empire Way, Wembley, Middlesex. (Class 17; February 22 1961.)

HYCO (805,810) Articles of clothing made of plastics; and articles of protective clothing for industrial operatives (other than clothing for protection against accident or injury). D. M. High and Co., Ltd. 1A West Bell Street, Dundee, Angus. To be associated with No. 805,809 (4304, 264). (Class 25; February 22, 1961.)

Increases of Capital

K.C. (Plastics) Ltd. (636,408), Adcroft Street, Stockport, Cheshire.—Increased on January 28 1960 by £9,900 in £1 ordinary shares, beyond the registered capital of £100.

John Kay and Graham (Plastics) Ltd. (641,131), 11 Parsons Green, S.W.6.—Increased on June 28 1960 by £2,000 in £1 ordinary shares, beyond the registered capital of £3,000.

Industrial Synthetics Ltd. (543,553).—Plastic manufacturers, etc., 77 South Audley Street, W.1. Increased on March 21 1960, by £20,000 in £1 ordinary shares, beyond the registered capital of £5,000.

B. Lipman Plastics (Sales) Ltd. (516,326).—Ling House, Dominion Street, E.C.2. Increased on June 27 1960, by £2,400 in £1 ordinary shares, beyond the registed capital of £100.

Bukit Mertajam Rubber Co. Ltd. (107,483), 69 Old Broad Street, E.C.2. Increased by £150,000 in 2s. shares, beyond the registered capital of £600,000, on November 18 1959.

Eastern Plantations and General Investment Co. Ltd. (234,777), 19 Leadenhall Street, E.C.3. Increased August 5 1960, by £150,000 in £1 unclassified shares, beyond the registered capital of £250,000.

CLASSIFIED ADVERTISEMENTS

RUBBER AND PLASTICS WEEKLY

APPOINTMENTS VACANT

6d. a word. Minimum 12/6 Box 2/-

ASSISTANT chief chemist. Applications are invited from qualified chemists with good knowledge of synthetic rubbers and plastics. Applicants should have first-class experience in chemistry.—Apply giving details of age, experience, qualifications, salary, etc. Personnel Manager, Fireproof Tanks Limited, The Airport, Portsmouth. (894)

CHEMIST/technologist required by progressive and rapidly expanding company in the plastics field located in the Home Counties. Candidates should hold BSc or API qualifications, although consideration will be given to applicants who have had full experience in the compounding of PVC. Age preferred 23/30 years.—Box 903. (903)

SERVICE engineer and demonstrator for injection moulding machines. Applicants should have experience of hydraulic equipment and also moulding technique. Appointment, which will be permanent and pensionable, is in London but will involve extensive travel. State age, education, training, experience and salary required.—Box 913. (913)

PLASTICS & RUBBER TECHNOLOGIST

An interesting new vacancy occurs on the staff of an expanding laboratory for a qualified young man, API or AIRI, and an interest in engineering, to assist with research and development work on a variety of rubber and plastic processing machines.

The position offers excellent prospects for a keen and energetic applicant, with initiative and able to take responsibility.

An attractive salary will be offered and there is a non-contributory pension scheme.

Please write with full details of age, experience and qualifications to

The Personnel Manager

FRANCIS SHAW & CO LTD

CORBETT STREET
MANCHESTER 11

(914)

APPOINTMENTS VACANT

STAFF APPOINTMENT

DESIGNER AND FITTER ENGINEER OF HOSE COUPLINGS

A vacancy exists for a new staff appointment with an old-established and progressive rubber hose manufacturer in Hertfordshire as a fitter engineer for designing and supervising the assembling of low pressure and high pressure cotton and wire braided hose couplings, and other hose fitting work.

Excellent prospects for staff promotion.

Age between 30 and 40 years. Previous experience very necessary.—Box 850. (850)

EXPERIENCED rubber works foreman (nights). Good pay and prospects.—Apply Sam Kay Rubber Co. Ltd., Hope Mills, Portwood Place, Stockport. (876)

LATEX TECHNOLOGIST

The International Synthetic Rubber Company Limited is continuing to extend its latex production facilities and to increase its Technical Service staff accordingly.

A Latex Technologist is required who will be engaged on the development of new and improved techniques in the use of latex. He will also be concerned with the development of new uses for synthetic rubber latex and in the evaluation of new latices.

Applicants should have had thorough academic and practical training in Latex Technology and should preferably be graduates in Chemistry or Rubber Technology. Applications are also invited from non-qualified Technologists who have had several years of suitable experience with latex.

The Company operates an enlightened personnel policy which includes generous holiday and sickness benefits and an excellent contributory pension scheme.

Our premises are located on the south coast adjacent to Southampton Water and the New Forest.

Housing can be made available after a short period of employment.

Applications stating age, qualifications and experience should be addressed to the Company Personnel Manager at Hythe, Southampton. (899)

LARKHILL RUBBER COMPANY LTD.

until recently the Rubber Division of C. & J. CLARK LIMITED, SHOEMAKERS

wish to appoint

SHIFT FOREMEN

at their new factory at YEOVIL, Somerset

Supervisory and technical experience in the Rubber Industry is essential.

Starting salary will be in the region of £1,000 - £1,250. Three weeks' holiday and good pension scheme.

Applications are invited and should be made to the Senior Personnel Officer, C. & J. Clark Limited, Street, Somerset, marking your envelope 'Private' and quoting reference number JT:PJB:19:3. (902)

APPOINTMENTS VACANT

THE DISTILLERS COMPANY LIMITED

RUBBER TECHNOLOGIST

The Company has a vacancy for a Rubber Technologist at the Barry, Glamorgan factory of the Plastics Division.

The duties at Barry involve technical service work, particularly the improvement of the properties of rubber compositions by the addition of synthetic resins. The man appointed will have one or more assistants as required.

Candidates, aged not over 35, must have at least four years' practical experience in the rubber industry. They should hold a qualification of the Institution of the Rubber Industry, or its equivalent, and provided they have the required technological experience, candidates holding H.N.C. in Chemistry will be considered.

Write:
STAFF MANAGER
THE DISTILLERS COMPANY LIMITED
21/22 BOLTON STREET
LONDON, W.1.

Quote Ref: 15/61. R.J.

(907)

ENGLISH subsidiary of American company requires an energetic, ambitious salesman conversant with the sale of rubber raw materials. Knowledge of the industry and practical side are desired while technical knowledge is not essential. This position affords an opportunity to develop new product outlets. The individual will have the opportunity to exercise his own initiative. Benefits commensurate with ability. Aged 30-35. Please reply giving full details of previous experience.—Box 898. (898)

OPPORTUNITY occurs offering excellent prospects with Home Counties rubber manufacturers for energetic and enterprising individual as assistant to managing director. Experience and knowledge of rubber industry in relation to manufacturing and merchanting sales, purchases, correspondence and progressing an advantage.—Apply with full details of experience, age and salary required in strictest confidence to Box 884. (884)

PRODUCTION manager for rubber company, Surrey (outer London). Fully experienced in mouldings, extrusions, etc. Good position for right man.—Full details stating age, experience, etc., to Box 904. (904)

SURREY rubber manufacturers seek the services of a young and energetic rubber technologist for works laboratory control and development of new products. The applicant should possess IRI diploma and experience in the cable and/or footwear trades would be an advantage.—Please write giving details of age, experience and salary requirements to Box 901. (901)

YOUNG chemist/rubber technologist required by progressive rubber company. Minimum qualification BSc (chemistry), ARIC or AIRI. Industrial experience desirable but not essential. Newly qualified candidates will be considered.—Apply in writing to Andre Rubber Co. Ltd., Kingston By-Pass, Surbiton, Surrey. (909)

WORKS CHEMIST

A well-known expanding company shortly transferring its production activities to Northern Ireland requires the services of a Chemist experienced in the compounding, moulding and treating of natural and synthetic rubbers.

A sound knowledge of control procedure is essential.

The prospects for an applicant with the desired abilities are excellent.

This appointment would ideally suit a person with suitable qualifications who originates from Ireland, and wishes to return.

The position would be at senior staff level, and superannuated.

Applications stating age, qualifications, married or single, and when available, should be addressed to **Box 893.**

(893)

APPOINTMENTS VACANT
(continued)

RUBBER and plastics technologist required as deputy to technologist in charge of rubber research and service laboratories of Midland manufacturer of chemicals for the rubber and plastics industry. Extension of service to the plastics industry contemplated. Prospect of the position developing into that of technical adviser to consumers of rubber and plastics chemicals. Good academic qualifications in science and technology essential. Experience with bias towards plastics rather than rubber preferred. Contributory pension scheme. Nominal 5-day week. Canteen facilities.—Apply giving details of age, education, training, qualifications, experience and salary expected to General Manager, Robinson Brothers Limited, Phoenix Street, West Bromwich, Staffs. (912)

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RUBBER & PLASTICS

MACHINERY

Why not see for YOURSELF

MACHINERY FOR SALE

6d. a word, Minimum 12/6 Box 2/-

FOSTER Wucher W.700 automatic plastics injection moulding machine with air-operated mould carriers, including control panel. In first-class working order and 'as new' condition. £7,500.—Replies Box 886. (886)

MANUFACTURERS of roughing machines for rubber sheeting, sponge rubber, splitting machines, leather cloth plant, embossing plates and rollers, spreading machines and presses.—G. L. Murphy Ltd., Imperial Works, Menston, Nr. Leeds. (238R)

600

HIGH PRESSURE COMPRESSORS

1-540 c.f.m. BELLISS & MORCOM 4-stage water cooled, 440 p.s.i., 293 r.p.m.

1-60 c.f.m. WEIR 3-stage water cooled, 800 p.s.i., 380 r.p.m.

1-45 c.f.m. REAVELL vertical 2-stage water cooled, 1000 p.s.i., 420 r.p.m.

2-40 c.f.m. REAVELL vertical 2-cylinder 4-stage water cooled, 3,500 p.s.i., 150 r.p.m. with 45 h.p. slipring motor.

GEORGE COHEN
SONS & CO. LTD.

Wood Lane, London, W.12
(Shepherds Bush 2070)

Stanningley, Nr. Leeds
(Pudsey 2241) (892)

MACHINERY FOR SALE

(continued)

NO. 11 Banbury. 8½in. extruder with 120/40 h.p. variable speed drive. 8in. Camelback extruder. 4½in. Camelback extruder. 48in. x 18in. calender with variable speed drive.—Reed Brothers (Engineering) Ltd., Replant Works, Woolwich Industrial Estate, London, S.E.18. Tel.: Woolwich 7611 (6 lines). (900)

ONE size CS5½D/TS3/IB/U double Deri-Sine pump, having two independent discharges of 2.5 and 1.2 g.p.m. up to a pressure of 2,000 p.s.i. Pumps direct driven by a 5 h.p. Brook 400/440 volts, 3-phase, 50 cycles Squirrel Cage flange and foot-mounted motor running at 1,450 r.p.m. Pump and motor mounted on a 25-gallon oil supply tank fitted with oil level gauge, oil filler and oil filter.—Box 897. (897)

PLASTIC injection moulding machine. Windsor 6oz. model SH6.—Fred Watkins (Engineering) Ltd., Coleford, Gloucestershire. Phone Coleford 2271/5. (863)

STEAM-HEATED rubber vulcanizing oven, 4ft. dia. x 6ft. long, in first-class condition.—Box 358. (358)

MACHINERY WANTED

6d. a word, Minimum 12/6 Box 2/-

AIR compressor 100 c.f.m. at 600 p.s.i.—Box 910. (910)

AMELLOR Equipment Ltd., Springfield Lane, Salford, 3, buy used machinery of Francis Shaw and Joseph Robinson manufacture.—Telephone Manchester, Blackfriars 1866. (797)

WANTED. Heavy 2-roll cracker, complete with drive and motor.—Box 896. (896)

REQUIRED. Blackfriars 12 x 24 rotary cutting machine, open spider type.—Full details, including price, to Box 911. (911)

WANTED, secondhand Dornbush type PVC embossing machine.—Box 871. (871)

CAPACITY AVAILABLE

6d. a word, Minimum 12/6 Box 2/-

SLITTING capacity. Plastic sheetings slit to narrow widths 3/16in. to ¾in.—Enquiries to Bias Bindings Co. Ltd., Gorgie Road, Edinburgh. (889)

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COMPANY engaged in the manufacture of mechanical rubber, including plastic foams, wishes to acquire established company in the same field. Net profits should be £5,000 to £25,000. —Full particulars to Box 905. (905)

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REQUIRED. Firm with capacity for supplying an extruded section from re-processed PVC scrap material in standard colours.—Send particulars to Box 908. (908)

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OR AS LINES AT 5s. 6d. PER LINE

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Regular quantities of sorted Resin and Micro Rubber waste for disposal, all colours in stock, always 200 tons in stock.

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Rushden, Northants.
Phone Rushden 3687, evenings Rushden 3329.
(906)

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6d. a word, Minimum 12/6 Box 2/-

SCISSORS, up to 7in. ground and set by London cutlers established over 100 years; 48 hours postal service, 1/6 per pair.—J. A. Fowler, 18/22 Bell Street, Edgware Road, London, N.W.1. PAD 1491. (74R)

PVC *Sheeting scrap all types colour sorted and mixed regular quantities available*

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Station Works, 75c Upper Richmond Road, Putney, S.W.15
VANDYKE 6925 (739)

ARTICLES WANTED

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THERMOPLASTIC scrap. We always buy large and small quantities and pay prompt cash.—Send offers to J. W. Nash and Co., Ltd., 27 Beethoven Street, London, W.10. Ladbroke 4655. (531)

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INDEX to ADVERTISERS

	Page
Abrasive Developments Ltd.	—
A.E.W. Ltd.	—
Allcock, J., & Sons Ltd.	viii
Amalgamated Oxides (1939) Ltd.	—
Anchor Chemical Co. Ltd.	Cover i
Anderson, Joseph, & Sons Ltd.	v
Armour Hess Chemicals Ltd.	—
Ashley Associates Ltd.	—
Associated-Rediffusion Ltd.	—
Astor Boisselier & Lawrence Ltd.	—
Baker Perkins Ltd.	—
Barfoot, T. W., & Webb, W. F.	—
Barwell Engineering Ltd.	—
Belgrave Industries (Exports) Ltd.	—
B.I.P. Chemicals Ltd.	—
Birch, Singleton, W., & Sons Ltd.	—
Boston Marine & General Eng. Co. Ltd.	—
Bridge, David, & Co. Ltd.	410
Bright, John, & Bros. Ltd.	Cover iii
British Electrical Development Association	—
British Geon Ltd.	—
British Nylon Spinners Ltd.	—
British Recovered Rubber Co. Ltd.	—
British Resin Products Ltd.	427
British Titan Products Co. Ltd.	—
Bush Beach & Segner Bayley Ltd.	—
Cabot Carbon Ltd.	425
Carter Bros. (Rochdale) Ltd.	—
Carlton Press Knives Ltd.	—
Chance & Hunt	ix
C.I.C. Engineering Ltd.	—
Cleggswood Oil Distillery Ltd.	—
Cohen, George, Sons & Co. Ltd.	—
Columbian International (Gt. Britain) Ltd.	—
Consolidated Zinc Corporation (Sales) Ltd.	vi
Corrosion Exhibition	—
Crosfield, Joseph, & Sons Ltd.	—
Croxton & Garry Ltd.	446
Derrick Davis Plastics Ltd.	—
Dietzel, Hugo	—
Dixon, T. H., & Co. Ltd.	—
Docker, John, & Co. (Engineers) Ltd.	409
Dunlop Rubber Co. Ltd.	—
Du Pont Co. (United Kingdom) Ltd.	—
Durham Raw Materials Ltd.	—
Economist Intelligence Unit Ltd., The	—
Ellison, George, Ltd.	—
English Clays Lovering Pochin & Co. Ltd.	—
English Electric Co. Ltd., The	iv
Esso	—
eur-O-matic	—
Fawcett Preston & Co. Ltd.	—
Ferguson, A. O., & Co. Ltd.	—
Ferguson, James, & Sons Ltd.	vii
Ferguson Shiers Ltd.	—
Firestone Tyre & Rubber Co. Ltd.	—
Foamair Ltd.	—
Geigy Company Ltd., The	—
Goodyear Tyre & Rubber Co. Ltd.	—
Greeff, R. W., & Co. Ltd.	—
Gresham & Craven Ltd.	—
Gummi und Asbest	—
H. F. Industrial Services Ltd.	—
H. K. Import & Export Ltd.	—
Halsteads Engineers (Leyland) Ltd.	—
Hankin, Geo., & Co. Ltd.	—
Hardman & Holden Ltd.	—
Hatcham Rubber Co. Ltd.	viii
Hay & Robertson Ltd.	—
Hilton, Wallace, & Co. Ltd.	445
Hubron Rubber Chemicals Ltd.	Cover iv
Hughes & Hughes Ltd.	—
Hunt Heat Exchangers Ltd.	—
Iddon Bros. Ltd.	—
Iliffe Industrial Publications Ltd.	—
Imperial Chemical Industries Ltd. (Billingham)	429
Imperial Chemical Industries Ltd. (Dyestuffs)	417
Imperial Chemical Industries Ltd. (Plastics—Darvic)	x
Imperial Chemical Industries Ltd. (Terylene)	—
Institution of the Rubber Industry	440
International Corporation Ltd.	—
International Synthetic Rubber Co. Ltd.	415
Ioco Ltd.	—
K. W. Chemicals	—
Kautschuk und Gummi	—
Kendell, T., & Sons Ltd.	—
Ketjen Carbon	—
Lankro Chemicals Ltd.	—
Laporte Titanium Ltd.	—
Latex Engineering Co.	438
Lavino (London) Ltd.	—
Leaver, Donald Ltd.	—
Leeds & Bradford Boiler Co. Ltd., The	—
Lindsay & Williams Ltd.	—
Lonabarc Ltd.	—
Londex Ltd.	—
London & Scandinavian	—
Lord, R., & Sons Ltd.	—
McKechnie Bros. Ltd.	—
Maclaine, Watson & Co. Ltd.	—
Mersey White Lead Co. Ltd., The	—
Metal Box Co.	—
Micafine Ltd.	—
Monsanto Chemicals Ltd.	—
Muehlstein, H., & Co. (London) Ltd.	—
Muller, Max	—
National Rubber Bureau	—
Nederlandsch Verkoopkantoor Voor Chemische Producten N.V.	—
New Conveyor Co. Ltd.	—
Noble Lowndes Pension Service, The	—
Northwestern Rubber Co. Ltd.	—
Novadel Ltd.	—
Oswald & Duncan Ltd.	—
Philblack Ltd.	—
Phoenix Rubber Co. Ltd.	—
PLA—MA Ltd.	—
Planters Engineering Co. Ltd.	viii
Polymer (United Kingdom) Ltd.	—
Preston Tyre Fabric Manufacturing Co. Ltd.	—
Price's (Bromborough) Ltd.	—
Pullen, James H., (1942) Ltd.	vi
Rubber Estate Agency Ltd.	—
Reed Bros. (Eng.) Ltd.	i
Revue Generale du Caoutchouc	—
Rhein-Chemie GmbH.	—
Robinson Bros. Ltd.	—
Robinson, Joseph, & Co. Ltd.	434
Rotunda Ltd	—
Rubber Age (New York) Ltd.	—
Rubber Latex Ltd.	438
Rubber Regenerating Co. Ltd. The,	Cover ii
Scott Bader & Co. Ltd.	—
Shaw, Francis, & Co. Ltd.	iii
Shell International Chemical Co. Ltd.	—
Shell Mex & B.P. Ltd.	—
Smith, Alfred, Ltd.	—
Smith, Wilfrid, Ltd.	—
Squire, Frederick, Ltd.	—
Stechler, L., & Co. Ltd.	—
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Stocker, W. B., & Co. Ltd.	—
Storeys of Lancaster	—
Stott, James, Ltd.	—
Sutcliffe Engineering Components Ltd.	—
Sutcliffe Speakman & Co. Ltd.	421
Tanner Bros. (Greenfield) Ltd.	432
Tilghman's Ltd.	—
Union Carbide Ltd.	—
United Norit Sales Corporation Ltd.	—
United Wire Works Ltd., The	—
Universal Oil Co. Ltd.	—
Universal Oil Products Co.	—
Vacu-Blast Ltd.	—
Verson Engineering Co. Ltd.	—
Wallace, H. W., & Co. Ltd.	—
Wallis Engineering Co.	—
Washington Chemicals	ii
Welwyn Tool Co. Ltd.	—
Witco Chemical Co. Ltd.	434
Zama Ltd.	—

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